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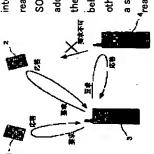
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(21)Application number: 2001-350868 (71)Applicant: SONY CORP

(22)Date of filing: 15.11.2001 (72)Inventor: TERAJIMA TORU

(54) RADIOCOMMUNICATION DEVICE AND ITS CONTROL METHOD, STORAGE MEDIUM AND COMPUTER PROGRAM



(57)Abstract:
PROBLEM TO BE SOLVED: To prevent interference between mutual radio tag

SOLUTION: The function equal to a radio tag is added to the radio tag readers/writers so that the radio tag readers/writers themselves can behave as the radio tag to a request from the other radio tag readers/writers. When receiving a sleep request from an external radio tag a sleep request from an external radio tag readers/writers is prohibited by interlocking with prohibition of the passive signal transmission in the radio tag to reduce interference of a request signal between the

other radio tag readers/writers.

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CLAIMS

[Claim(s)]

[Claim 1] It is the radio communication equipment which is a radio communication equipment which transmits and receives wireless data, is equipped with the passive communications department which returns the reply signal over this while receiving the demand signal from the outside, and the active communications department which

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receives the reply signal over this while transmitting a demand signal outside, and is characterized by the thing said passive communications department answers having received the sleep demand signal, lapse into sleeping, and it stops answering a demand signal for from the outside.

[Claim 2] Said passive communications department is a radio communication equipment according to claim 1 characterized by what sleeping is canceled according to having received the sleep discharge demand signal, and the response to the demand signal from the outside is resumed for.

[Claim 3] Between sleeping and for said active communications department, said passive communications department is the radio communication equipment according to claim 1 with which it is characterized by what transmission of a demand signal is forbidden for.

[Claim 4] It is the radio communication equipment according to claim 1 which said active communications department is a wireless tag reader which modulates a demand signal and is sent out as an electric wave of predetermined transmit frequencies, and is characterized by what said passive communications department is a wireless tag which recognizes the demand signal received from the outside in the state of non-contact.

[Claim 5] Said active communications department is a radio communication equipment according to claim 1 which is the IC card reader which receives a reply signal, applying a modulation to the signal which appears according to the load effect between the antennas in said passive communications department, and is characterized by what said passive communications department is an IC card to which the load between own antennas is changed according to the reply signal over the demand signal from the

[Claim 6] With the passive communications department which returns the reply signal over this while receiving the demand signal from the outside It has the active communications department which receives the reply signal over this while transmitting a demand signal outside. The control approach of the radio communication equipment characterized by what it has for the step to which are the control approach of the radio communication equipment which transmits and receives wireless data, and said passive communications department lapses into sleeping, and stops answering having received the sleep demand signal and answering a demand signal from the outside.

[Claim 7] The control approach of the radio communication equipment according to claim 6 characterized by what it has further for the step which said passive

communications department cancels sleeping according to having received the sleep discharge demand signal, and resumes the response to the demand signal from the

[Claim 8] The control approach of the radio communication equipment according to claim 6 characterized by what it has further for the step which said passive communications department forbids transmission of the demand signal by said active communications department between sleeping.

[Claim 9] It is the control approach of the radio communication equipment according to claim 6 which said active communications department is a wireless tag reader which modulates a demand signal and is sent out as an electric wave of predetermined transmit frequencies, and is characterized by what said passive communications department is a wireless tag which recognizes the demand signal received from the outside in the state of non-contact.

[Claim 10] Said active communications department is the control approach of the radio communication equipment according to claim 6 characterized by what is been the IC card to which the load between own antennas is changed according to a reply signal [as opposed to / are the IC card reader which receives a reply signal, applying a modulation to the signal which appears according to the load effect between the antennas in said passive communications department, and / the demand signal from the outside in said passive communications department].

[Glaim 11] With the passive communications department which returns the reply signal over this while receiving the demand signal from the outside It is the storage which stored physically the computer software described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system in the computer-readable format. The step which it answers that said computer software received the sleep demand signal, and said passive communications department lapses into sleeping, and is answered and made into a demand signal from the outside, The step which said passive communications department cancels sleeping and makes resume the response to the demand signal from the outside according to having received the sleep discharge demand signal, The storage characterized by providing the step which said passive communications department forbids transmission of the demand signal by said active communications department between sleeping.

[Claim 12] With the passive communications department which returns the reply signal over this while receiving the demand signal from the outside It is the computer

program described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system. The step which it answers having received the sleep demand signal, and said passive communications department lapses into sleeping, and is answered and made into a demand signal from the outside. The step which said passive communications department cancels sleeping and makes resume the response to the demand signal from the outside according to having received the sleep discharge demand signal, The computer program characterized by providing the step which said passive communications department forbids transmission of the demand signal by said active communications department between sleeping.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[100

[Field of the Invention] This invention relates to the radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having started the radio communication equipment which operates comparatively in the radio area of a short distance and its control approach, the storage, and the list at the computer program, for example, having received the electric wave of a specific frequency, and is equivalent to identification information or the information memorized and its control approach, a storage, and a list at a computer program.

[0002] Furthermore, in detail, this invention relates to the radio communication

equipment which equips a wireless tag, and a wireless tag reader / writer ability and its control approach, a storage, and a list at a computer program, and relates to the radio communication equipment which prevents interference of a wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list at a computer program.

[0003]

[Description of the Prior Art] The radio frequency identification unit (wireless tag) of current and a non-contact mold is used by many systems, such as an unapproved carrying-out prevention system in dealers, such as a system of tariff liquidation in the system which manages close leaving, the goods discernment system in the PD, a dining-room, etc., CD, and software.

[0004] A wireless tag can specify what it is a device including the identification information of a proper, or the storage region which can be written, and it is by reading the information which has the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized, and is written in the identification information and the storage region of a wireless tag by the reader side. Therefore, in the system using the information currently written in the identification information and the storage region of a wireless tag, distinction of goods, an owner's distinction, etc. can be performed using ID of a proper and the information on other which are written in.

[0005] For example, it is indicated by JP,6-123773,A about the radio frequency identification unit which package-izes IC chip equipped with transmission and reception and a memory function, the driving source of this chip, and an antenna, and is manufactured small. While according to this radio frequency identification unit transmitting various data about goods etc. to the receiving means of IC chip via an antenna and accumulating that output in memory, the data in memory can be read if needed and it can supply outside on radio through an antenna. Therefore, it is possible to check existence of goods etc. and a location quickly and easily, or to pursue. [0006] By the way, in the same radio area, the equipment with which such wireless tag system performs reading or the writing to a wireless tag fundamentally is designed on the assumption that there is only one. For this reason, under the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area, it interferes each other and good radio cannot be performed. [0007] For example, to access from one a wireless tag reader / writer, two or more

wireless tags may answer, or two or more wireless tag reader / writers may try access to the same wireless tag. [0008] for example, in the ** table No. 513841 [2000 to] official report When answering appeal from one RF/ID reader, in order that two or more RF/ID tags may solve the problem of colliding mutually A tag with a different bitwise response from the response as which bitwise was determined beforehand is deactivated (deactivate). By activating alternatively a tag with the response as which bitwise was determined beforehand (activate), it is indicated about the approach and equipment for a RF discernment tag which are clearly obtained from two or more tags.

[0009] The problem that the response from a wireless tag will interfere mutually is avoidable by making the wireless tag which the reader/writer of a wireless tag does not make the partner of access be deactivated or sleep as proposed in this official report.

[0010] However, case [like a wireless tag with a reader/writer function which was mentioned above], even if the situation in which a wireless tag will be in sleeping and a response interferes each other is avoidable, the problem that the demand from the reader/writer function will interfere with other reader/writers is still left behind.
[0011] Probably, the problem of interference of the communication link in such same radio area is applied also in a well-known IC card and IC card reader/writer as non-contact communication system. An IC card communicates by applying amplitude modulation to the signal which appears in the receiving circuit of reader/writer by changing the load between own antennas according to the reply signal over the question signal from reader/writer.

1012]

[Problem(s) to be Solved by the Invention] The purpose of this invention is to provide the outstanding radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized and its control approach, a storage, and a list with a computer program.

[0013] The further purpose of this invention is to provide with a computer program the outstanding radio communication equipment which equips the both sides of a wireless tag, and a wireless tag reader / writer ability, and operates suitably in radio area and

[0014] The further purpose of this invention is to provide with a computer program the outstanding radio communication equipment which can prevent interference of a

its control approach, a storage, and a list.

wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list.

<u>8</u>

equipment characterized by the thing answer having received the sleep demand signal, demand signal, and said passive communications department lapses into sleeping, and which transmits and receives wireless data, and returns the reply signal over this while signal from the outside It has the active communications department which receives the reply signal over this while transmitting a demand signal outside. It is the control consideration of the above-mentioned technical problem. The 1st side face With the characterized by what it has for the step to which answer having received the sleep reply signal over this while the 2nd side face of this invention receives the demand passive communications department which is the radio communication equipment department which receives the reply signal over this, while transmitting a demand signal outside, said passive communications department is a radio communication [0016] With moreover, the passive communications department which returns the wireless data, and is the control approach of the radio communication equipment receiving the demand signal from the outside Having the active communications apse into sleeping, and it stops answering a demand signal for from the outside. approach of the radio communication equipment which transmits and receives [Means for Solving the Problem and its Function] This invention is made in stops answering a demand signal from the outside.

[0017] According to the radio communication equipment concerning the 1st or 2nd side face of this invention, or its control approach, even if it is a case so that two or more radio communication equipments may be intermingled in the same radio area, the reply signal from two or more passive communications departments which receive the same demand signal can interfere, and a certain thing can be avoided.

[0018] Said passive communications department cancels sleeping according to having received the sleep discharge demand signal by sleeping, and the response to the

received the sleep discharge demand signal by sleeping, and the response to the demand signal from the outside is resumed.
[0019] Moreover, as for said active communications department, transmission of a demand signal is forbidden for said passive communications department between sleeping. Therefore, even if it is a case so that two or more radio communication

equipments may be intermingled in the same radio area, the demand signal from the mutual active communications department can interfere, and a certain thing can be

[0020] Here, said active communications department can constitute as a wireless tag reader which modulates a demand signal and is sent out as an electric wave of predetermined transmit frequencies. Moreover, said passive communications department can constitute as a wireless tag which recognizes the demand signal received from the outside in the state of non-contact.

[0021] That is, the wireless tag reader itself can carry out behavior as a wireless tag to the demand from other wireless tag readers by adding a function equivalent to a wireless tag to a wireless tag reader. In such a case, when a sleep demand is received from an external wireless tag reader, the radio communication equipment concerning the 1st side face of this invention can be interlocked with forbidding the passive signal transmission in a wireless tag, and can mitigate interference of a demand signal among other wireless tag readers by forbidding the active signal transmission in a wireless tag reader.

[0022] Or said active communications department can constitute as an IC card reader which receives a reply signal, applying a modulation to the signal which appears according to the load effect between the antennas in said passive communications department. Moreover, said passive communications department can constitute as an IC card to which the load between own antennas is changed according to the reply signal over the demand signal from the outside.

[0023] In such a case, when a sleep demand is received from an external IC card reader, the radio communication equipment concerning the 1st side face of this invention can be interlocked with forbidding the passive signal transmission in an IC card, and can mitigate interference of a demand signal among other IC card readers by forbidding the active signal transmission in an IC card reader.

10024] With moreover, the passive communications department which returns the reply signal over this while the 3rd side face of this invention receives the demand signal over this while the storage which stored physically the computer software described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system in the computer-readable format. The step which it answers that said computer software received the sleep demand signal, and said passive communications department lapses into sleeping, and is answered and made into a demand signal from the outside, The step which said passive communications department cancels sleeping and makes resume the response to the demand signal from the outside according to having received the sleep discharge demand signal, Said passive communications department

is the storage characterized by providing the step which forbids transmission of the demand signal by said active communications department between sleeping.

[0025] The storage concerning the 3rd side face of this invention is a medium which offers computer software in a computer-readable format to the general purpose computer system which can perform various program codes, for example. Attachment and detachment of DVD (Digital Versatile Disc), CD (Compact Disc), FD (FloppyDisk), MO (Magneto-Optical disc), etc., etc. are free for such a medium, and it is a storage of portability. Or it is also technically possible to provide specific computer system with computer software via transmission media, such as a network (for a network not to ask distinction of wireless and a cable), etc.

or a function. If it puts in another way, by installing predetermined computer software in computer system through the storage concerning the 3rd side face of this invention, signal from the outside It is the computer program described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on communications department cancels sleeping and makes resume the response to the realizing the function of computer software predetermined in a computer system top, computer system. The step which it answers having received the sleep demand signal, collaboration-relation on the structure of the computer software and the storage for operation effectiveness as the radio communication equipment concerning each 1st charactenized by providing the step which forbids transmission of the demand signal reply signal over this while the 4th side face of this invention receives the demand and said passive communications department lapses into sleeping, and is answered demand signal, Said passive communications department is the computer program [0027] With moreover, the passive communications department which returns the demand signal from the outside according to having received the sleep discharge [of this invention] and 2nd side faces or its control approach can be acquired. on computer system, a collaboration-operation is demonstrated and the same and made into a demand signal from the outside, The step which said passive [0026] The storage concerning the 3rd side face of this invention defines the by said active communications department between sleeping.

[0028] The computer program concerning the 4th side face of this invention defines the computer program described to realize processing predetermined in a computer system top in the computer-readable format. If it puts in another way, by installing the computer program concerning the 4th side face of this invention in computer system, on computer system, a collaboration-operation is demonstrated and the same

operation effectiveness as the radio communication equipment concerning each 1st of this invention I and 2nd side faces or its control approach can be acquired.

[0029] The purpose, the description, and advantage of further others of this invention will become [rather than] clear by detailed explanation based on the operation gestalt and the drawing to attach of this invention mentioned later.

0030]

[Embodiment of the Invention] Hereafter, it explains in detail about the operation gestalt of this invention, referring to a drawing.

[0031] The situation of radio area which realized this invention is shown in <u>drawing 1</u>. In this radio area, two or more reader writer equipments are intermingled in two or more wireless tags and a list. In this drawing, reference numbers 1 and 2 are wireless tags, and reference numbers 3 and 4 are a wireless tag reader / writer. Hereafter, when you only call it "a wireless tag reader / writer", suppose that it is the radio communication equipment equipped with a wireless tag and the both sides of a reader/writer function.

[0032] In the example shown in <u>drawing 1</u>, read-out or a write request is transmitted to the wireless tags 1 and 2 with which a wireless tag reader / writer 3 exists in the same radio area, and a list to a wireless tag reader / writer 4, and signs that the response is received are shown. In this case, if it sees from a wireless tag reader / writer 3, a wireless tag reader / writer 4 will act like the wireless tags 1 and 2. That is, a wireless tag reader / writer 3 also recognizes a wireless tag reader / writer 4 as one of the wireless tags.

[0033] Furthermore, in the example shown in this drawing, in order to mitigate the interference to a wireless tag reader / writer 3, the wireless tag reader / writer 4 has controlled sending out a sending signal active as reader/writer.

[0034] The hardware configuration of the radio communication equipment 100 equipped with the function of a wireless tag and the both sides of reader/writer is typically shown in <u>drawing 2</u>. Hereafter, each part is explained, referring to this

[0035] A reference number 101 is a non-volatile storage region, for example, consists of nonvolatile memory equipment in which writing like EEPROM (Electrically Erasable and Programmable ROM) is possible, and external storage like hard disk equipment. This non-volatile storage region 101 is equipped with the usable storage region general-purpose [the control-software storing field holding the program code for controlling actuation of a radio communication equipment 100, the virtual tag storage region used when a radio communication equipment 100 acts as a wireless tag (or

other passive communication devices), and others].

memory equipment in which rewriting like RAM (Random Access Memory) is possible. Moreover, a reference number 104 is temporary storage 104, and consists of volatile outton, or a touch panel on which the display screen of a display 102 was overlapped. FPGA (Field Programmable Gate Array) into which a user can change internal logic by 0038] A reference number 105 is the input section for a user to input an actuation control-software storing field of the non-volatile storage region 101, and saves the functional module which performs the exterior and radio according to the command Communications Department 106 can consist of general-purpose logic devices like command, data, etc. The input section 105 consists of two or more keys, a carbon [0037] A reference number 103 is CPU (Central Processing Unit) which controls consists of liquid crystal display displays (LCD), and it is used in order to display CPU103 performs the program code loaded on temporary storage 104 from the [0039] A reference number 106 is the Radio Communications Department, is a [0036] A reference number 102 is a display with an output screen, for example, from CPU103, and is equipped with RF block which transmits and receives the actuation of the radio-communication-equipment 100 whole in generalization. activity data under program execution in temporary storage 104 temporarily. baseband block which manages transmission and reception of a signal, and predetermined RF signalling frequency through an antenna 107. The Radio actuation of a radio communication equipment 100 and a condition the program after IC completion.

[0040] With this operation gestalt, the Radio Communications Department 106 has the passive communication facility which receives the demand signal from the outside and returns a reply signal, and the active communication facility which receives the reply signal from the exterior while transmitting a demand signal outside. However, the after-mentioned is yielded about these details.

[0041] A reference number 108 is an external interface, and it can be used in order to connect a radio communication equipment 100 with a computer, other information machines and equipment, and an information processing terminal. An external interface is Ethernet, RS232C, and USB (Universal Serial Bus), IrDA, Bluetooth and IEEE. It can constitute from standard interfaces, such as 802.11b.

[0042] The functional configuration of the Radio Communications Department 106 is typically shown in <u>drawing 3</u>. As shown in this drawing, it has passive communications department 106A which receives the demand signal from the outside and returns a reply signal, and active communications department 106B which receives the reply

signal from the exterior while transmitting a demand signal outside.

[0043] Passive communications department 106A can be read from the exterior, and can receive demand signals, such as a demand, and a sleep demand besides a write request, a sleep discharge demand. When a read-out demand is received, a letter is answered in the requested data stored in the virtual tag storage region of the non-volatile storage region 101. Moreover, when a write request is received, requested data is written in the virtual tag storage region of the non-volatile storage region 101.

[0044] Moreover, passive communications department 106A answers having received the sleep demand, and lapses into sleeping. It stops answering a read-out demand and a write request from the outside in sleeping. For example, when two or more passive communications department 106A in the same radio area is intermingled, the problem that the response from passive communications department 106A will interfere mutually can be avoided by setting it except specific passive communications department 106A as sleeping. Sleeping is continued until it receives a sleep discharge demand and sleep is canceled.

[0045] Passive communications department 106A holds any of an own condition, i.e., sleeping, or a sleep discharge condition they are to condition attaching part 106C. Active communications department 10B can access condition attaching part 106C of passive communications department 106A.

[0046] One active communications department 106B can receive the reply signal over this while it is read outside and transmits demand signals, such as a demand, and a sleep demand besides a write request; a sleep discharge demand. By transmitting a sleep demand, the sleeping can be canceled by making the other party's passive communications department 106A change to sleeping, and transmitting a sleep discharge demand.

[0047] Active communications department 10B distinguishes whether passive communications department 106A is sleeping with reference to condition attaching part 106C in passive communications department 106A, before transmitting a demand signal. And if it is sleeping, sending out of a demand signal will be disabled, this — for example, when two or more active communications department 10B is intermingled in the same radio area, the problem that a demand signal will interfere mutually can be avoided.

[0048] A wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency as an example of the combination of passive communication facility and active

communication facility, and is equivalent to identification information or the information memorized, and a wireless tag reader / writer can be mentioned.

[0049] Here, the structure to which the wireless tag reader / writer as the active communications department carry out R/W actuation to the wireless tag as the passive communications department is explained, referring to <u>drawing 4</u>. a wireless transmission and reception in the example of illustration sake — electromagnetism—the transfer method is adopted.

[0050] In this drawing, a reference number 11 is a wireless tag and consists of a tag chip 12 and an antenna 13. [0051] The dipole antenna of the half-wave length etc. is used for an antenna 13. Moreover, the tag chip 12 consists of the modulation section 20, the rectification / recovery section 22, and the memory section 23. The memory section 23 is equivalent to a virtual tag storage region (above-mentioned).

[0052] It is received by the antenna 13 and the electric wave fo transmitted from the wireless tag reader / writer 10 is inputted into rectification / recovery section 22. Here, a recovery function carries out initiation of operation according to this power source, and it is recognized that it is a reading signal over the wireless tag 11 at the same time an electric wave fo is rectified and it is changed into DC power supply. The generated power source is supplied also to the memory section 23 and the modulation section 20.

[0053] The memory section 23 reads information, such as ID beforehand stored in the interior, and sends it to the modulation section 20 as transmit data. The modulation section 20 consists of diode switches 21, and a diode switch 21 repeats ON / off actuation with transmit data. That is, when data are 1, it becomes ON and termination of the antenna 13 is carried out with an antenna impedance (for example, 50 ohms). [0054] At this time, the electric wave from a wireless tag reader / writer 10 is absorbed by the wireless tag 11 side. When data are 0, it becomes off, and a diode switch 21 will be in an opening condition, and the termination of an antenna 13 will also be in an opening condition at coincidence. At this time, it will be reflected and the electric wave from a tag reader / writer 10 will return to a transmitting agency. [0055] Such a correspondence procedure is called a "back-scatter method." In this way, the wireless tag 11 becomes possible [sending the information on internal to wireless tag reader / writer 10 side with a non-power source].

[0056] One wireless tag reader / writer 10 consist of antennas 15 connected to the tag reading module 14 and this tag reading module 14, and is used, connecting with the host device 16. The host device 16 consists of information terminals, such as CPU103

in a radio communication equipment 100, a personal computer further connected by external-interface 108 course, and PDA (Personal Digital Assistant), and offers a user interface for a user to perform a dialogue input.

(0057] The host device 16 notifies reading directions of the wireless tag 11 to the communications control section 30 via the host interface section 31 first.

[0058] The baseband processing section 29 sends baseband signaling to the ASK (Amplitude Shift Keying) modulation section 27, after filtering by editing into transmit data, if the reading command of the tag from the communications control section 30 is received. The ASK modulation section 27 performs an ASK modulation on the frequency fo of a frequency synthesizer 26.

[0059] The frequency setting of a frequency synthesizer 26 is performed by the communications control section 30. Generally, for mitigation of the standing wave of the signal from the wireless tag 11, or a multi-pass, the hopping of the transmit frequencies to the wireless tag 11 is carried out, and they are used. Directions of this hopping are also performed by the communications control section 30. The sending signal to which the ASK modulation was applied is emitted towards the wireless tag 11 via a circulator 24 from an antenna 15.

[0060] As stated previously, the reflective signal from the wireless tag 11 which has returned by the back-scatter method is the same frequency as the signal transmitted from the wireless tag reader / writer 10. It is received by the antenna 15 of a wireless tag reader / writer 10, and this signal is inputted into a mixer 25.

[0061] Since the same local frequency fo as the time of transmission is inputted into a mixer 25, in the output of a mixer 25, the signal to which the modulation was applied by the wireless tag 11 side will appear.

[0062] In the recovery section 28, it recovers from this signal to the data of 1/0, and sends to the baseband processing section 29, data are decoded and the data stored in the memory section 23 in the wireless tag 11 are taken out. This data is transmitted to the host device 16 from the host interface section 31 according to directions of the communications control section 30. [0063] A wireless tag reader / writer 10 can read the information in the wireless tag 11 as mentioned above. Moreover, a wireless tag reader / writer 10 can perform write—in actuation to the wireless tag 11 in the same actuation as ***** In this case, the the data by the side of the host device 16 can be written in the memory section

[0064] Moreover, IC card reader/writer can be mentioned to the noncontact IC card list which communicates by applying amplitude modulation to the signal which appears

23 (namely, virtual tag storage region) in the wireless tag 11.

in the receiving circuit of reader/writer by changing the load between own antennas according to the reply signal over the demand signal from reader/writer as other examples about the combination of passive communication facility and active communication facility.

[0065] Radio between an IC card and IC card reader/writer is realized based on the principle of electromagnetic induction. In <u>drawing 5</u>, the structure of the radio of an IC card and IC card reader/writer based on electromagnetic induction is illustrated notionally. IC card reader/writer is equipped with the antenna LRW which consisted of loop-formation coils, and a field is generated by passing Current IRW at this antenna LRW around it. On the other hand, the loop-formation coil Lc is electrically made with the IC card side around the IC card. In the loop-formation coil Lc edge by the side of an IC card, the induced voltage by the field which the loop antenna Lc by the side of IC card reader/writer emits arises, and it is inputted into the terminal of the IC card connected to the loop-formation coil Lc edge.

elationship, the loop-formation coil Lc by the side of the antenna LRW by the side of C card reader/writer and an IC card can be caught if one transformer is formed as a Antenna LRW, the electrical potential difference VO by which induction is carried out appear. By restoring to a part for this fluctuation, IC card reader/writer can receive [0068] Moreover, an IC card has the function (Load Switching) to fluctuate the load oop-formation coil Lc is changed, in an IC card reader/writer side, the impedance between antenna terminals changes, and it will become fluctuation of the passage [0067] At an IC card reader/writer side, in modulating the current IRW passed at current IRW of Antenna LRW, or an electrical potential difference VRW, and will system, and as shown in drawing 6, it can model R/W actuation of an IC card. to the loop-formation coil Lc on IC chip can receive a modulation, and IC card between the terminals of the loop-formation coil Lc according to the data for [0066] Although the degree of coupling changes according to mutual physical returning IC card reader/writer. If the load between the terminals of the reader/writer can perform data transmission to an IC card using that. the return data of an IC card.

[0069] Namely, an IC card can communicate by applying amplitude modulation to the signal which appears in the receiving circuit by the side of card R/W equipment by changing the load between own antennas according to the reply signal over the demand signal from IC card reader/writer.

[0070] In the form of the flow chart shows the signal reception actuation in a radio communication equipment 100 to <u>drawing 7</u>. A radio communication equipment makes

possible behavior as passive communication facility like the usual wireless tag (or IC card), and this actuation is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the signal reception in a radio communication equipment 100 is explained, referring to this flow chart.

[0071] If signal reception starts in a radio communication equipment 100, in step S1, sleeping will be initialized off first. And it will be in the condition of the waiting for signal reception at step S2 after this.

[0072] In a signal receiving waiting state, if a radio communication equipment 100 receives a reply signal from passive communication facility, such as an external wireless tag (or IC card), or receives a demand signal from active reception functions, such as a wireless tag reader / writer (or IC card reader/writer), it will progress to step S3 and sleeping will be judged.

[0073] In the decision block S3, when judged with sleeping being ON, it progresses to step S4 and judges whether the signal received further is a sleep discharge demand. In the case of signals other than a sleep discharge demand, the radio communication equipment 100 during sleep waits for return and the next signal reception to step S2, without processing anything.

[0074] On the other hand, when judged with it being a sleep discharge demand in step S4, after progressing to degree step S5 and setting up sleeping off, it waits for return and the next signal reception to step S2.

[0075] If processing in step S5 is performed, sleeping is canceled, and this radio communication equipment 100 will be in the condition that various demands as a wireless tag reader / a writer (or IC card reader/writer) can be transmitted while being in the condition that it can answer to various demands as passive communication facility, such as a wireless tag (or IC card).

[0076] Moreover, in the decision block S3, when judged with sleeping being off, the signal progressed and received to step S6 judges whether it is a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), or it is a reply signal from passive communication facility, such as other wireless tags (or IC card).

[0077] In the decision block S6, when judged with it being a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), it progresses to step S7 and judges whether an input signal is a sleep

demand further.

[0078] When judged with it being a sleep demand in the decision block S7, after setting sleeping as ON in a degree S8, it waits for return and the next signal reception to step S2

[0079] If step S8 is processed, this radio communication equipment 100 will not transmit various demands as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer), while stopping answering to various demands as passive communication facility, such as a wireless tag (or IC card), until sleeping is canceled.

[0080] Moreover, in the decision block S7, when judged with an input signal being except a sleep demand, it progresses to step S10 and the Radio Communications Department 106 performs, the behavior, i.e., the demand reception, as passive communication facility, such as a wireless tag (or IC card). Then, it waits for return and the next signal reception to step S2. <u>Drawing 9</u> explains the demand reception in step S10 separately on the relation of space.

[0081] When it judges that an input signal is not a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), in the decision block S6, namely, when judged with it being a reply signal from passive communication facility, such as other wireless tags (or IC card) It progresses to step S9 and performs, the behavior, i.e., the response reception, as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer). Then, it waits for return and the next signal reception to step S2.

Drawing 8 explains the response reception in step S9 separately on the relation of space.

[0082] In the form of the flow chart shows the procedure of the response reception in step 9 in the flow chart shown in <u>drawing 7</u> to <u>drawing 8</u>. As for this response reception, a radio communication equipment 100 is equivalent to the behavior as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer). This response reception is realized with the gastalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the response reception of a radio communication equipment 100 is explained, referring to

[0083] A radio communication equipment 100 creates a response result after reply signal reception initiation, returns processing to the procedure of call origin (step S21),

and ends response reception.

write request, it progresses to step S35 and performs write-in processing. It is writing the demanded information in the demanded location to the virtual tag storage region in demand reception, a radio communication equipment 100 is equivalent to the behavior Department 106 constituted by FPGA etc. Hereafter, the demand reception of a radio discernment demand. In being ID discernment demand, it progresses to step S32 and passive communication facility's, such as this wireless tag's, has. With this operation CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to performs ID discernment processing. ID discernment processing is reading ID which as passive communication facility, such as a wireless tag (or IC card). This demand eception is realized with the gestalt of performing the control software with which subsequently in step S34, it will distinguish whether it is a write request. In being a [0084] Moreover, in the form of the flow chart shows the procedure of the demand 0085] First, in step S31, it distinguishes whether the demand which received is ID reception in step 10 in the flow chart shown in drawing 7 to drawing 9 . As for this realize by the logic mounted in the baseband block in the Radio Communications the non-volatilized storage region 101 indicated to be write-in processing in this [0086] Moreover, if the demand which received is not ID discernment demand, non-volatilized storage region 101, and it is sent out to a requiring agency. gestalt, ID is read from the inside of the virtual tag storage region of the communication equipment 100 is explained, referring to this flow chart. operation gestalt to drawing 2.

[0087] Moreover, if the demand which received is not a write request, subsequently in step S36, it will distinguish whether it is a read-out demand. In being a read-out demand, it progresses to step S37 and performs read-out processing. It is reading in the demanded size from the location of which the information currently held in the virtual tag storage region in the non-volatilized storage region 101 indicated to be read-out processing in this operation gestalt to <u>drawing 2</u> was required.

[0088] After processing the demand which these-received, a reply signal is transmitted to a requiring agency at step S33, and this whole manipulation routine is ended.

[0089] Moreover, in the form of the flow chart shows procedure for a radio communication equipment 100 to perform signal transmitting processing to <u>drawing</u>.

10. According to this procedure, in case it acts as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer), transmitting processing of an active demand signal is restricted according to the condition (that is, is it sleeping

or not?) of passive communication facility, such as a wireless tag (or IC card). [0090] This procedure is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the signal transmitting processing in a radio communication equipment 100 is explained, referring

[0091] In case a radio communication equipment 100 transmits various demand signals by actuation of the control software stored in the non-volatilized storage region 101, it distinguishes first whether passive communication facility section 106A, such as a wireless tag (or IC card), is sleeping in step S41.

[0092] Since there is no fear of a demand signal interfering mutually among other radio communication equipments when judged with it not being sleeping, it progresses to step S42 and demand signal transmission is performed as it is.

[0093] On the other hand, in the decision block S41, when judged with passive communication facility section 106A, such as a wireless tag (or IC card), being sleeping, in order to restrict signal transmission and to avoid interference with other demand signals, it progresses to step S43, under sleep is set as a response result, and this manipulation routine is ended.

[0094] The demand signal used for the following table 1 between the radio communication equipments which consist of a wireless tag and wireless tag reader writer equipment is packed. The radio communication equipment 100 in the operation gestalt of this invention mentioned above needs to have at worst the function in which these demand signals can be transmitted. About the demand signal except having been shown here, addition and modification of may be done if needed.

[Table 1]

G54名	25-00
I D 開別要求	周囲の無線タグ、無線タグリーダ・ライタ装置が持つ I Dを取得するための要求信号。
スリーブ要求	周囲の無線タグ、無値タグリーダ・ライタ装置に対し でスリーブ状態にさせるための要求信号。
スリーブ解除要求	周囲の無線タグ、無線タグリーダ・ライタ装置に対し てスリーブ状態を解除させるための要求信号。
書き込み要求	周囲の無線タグ、無線タグリーダ・ライタ装置に対し で情報を書き込むための要求信号。
節み出し要求	周囲の無緯タグ、無線タグリーダ・ライタ装置から情 報を読み出すための要求信号。

[0096] Moreover, the reply signal used for the following table 2 between the radio communication equipments which consist of a wireless tag and wireless tag reader writer equipment is packed. The radio communication equipment 100 in the operation form of this invention mentioned above needs to have at worst the function in which these reply signals can be transmitted. About the reply signal except having been shown here, addition and modification of may be done if needed.

[200]

[Table 2]

信号名	内容
I D體別応答	無線タグ、無線タグリーダ・ライタ装置が持つIDを 要求元に返すための応答信号。
書き込み応答	無線タグ、無線タグリーダ・ライタ装置が持つ記憶領域に情報を書き込んだ結果を返すための店答信号。
簡み出し応答	無様タグ、無様タグリーダ・ライタ装置が持つ記憶質 域から情報を読み出した結果を返すための店客信号。

[0098] It has explained in detail about this invention, referring to a specific operation gestalt more than [addenda]. However, it is obvious that this contractor can accomplish correction and substitution of this operation gestalt in the range which does not deviate from the summary of this invention. That is, this invention should not be indicated with the gestalt of instantiation, and the written contents of this specification should not be interpreted restrictively. In order to judge the summary of this invention, the column of the claim indicated at the beginning should be taken into consideration.

6600

[Effect of the Invention] As a full account was given above, according to this invention, the outstanding radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized and its control approach, a storage, and a list can be provided with a computer program.

[0100] Moreover, according to this invention, the outstanding radio communication equipment which equips the both sides of a wireless tag, and a wireless tag reader / writer ability, and operates suitably in radio area and its control approach, a storage, and a list can be provided with a computer program.

[0101] Moreover, according to this invention, the outstanding radio communication

equipment which can prevent interference of a wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list can be provided with a computer program.

[0102] According to this invention, in the radio communications system which serves as a wireless tag from a wireless tag reader / writer, wireless tag R/W equipment itself can carry out behavior as a wireless tag to the demand from other wireless tag R/W equipments by adding a function equivalent to a wireless tag to a wireless tag reader / writer. Moreover, when a sleep demand is received from external wireless tag reader / writer, forbidding the passive signal transmission in a wireless tag can be interlocked with, and interference of a mutual demand signal with other wireless tag reader writers can be mitigated by forbidding the active signal transmission in a wireless tag reader / writer.

[0103] Furthermore, according to this invention, since the above-mentioned effectiveness is acquired without adding modification to especially the wireless specification between a wireless tag, and a wireless tag reader / writer, mounting cost can be reduced sharply.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having started

the radio communication equipment which operates comparatively in the radio area of program, for example, having received the electric wave of a specific frequency, and is a short distance and its control approach, the storage, and the list at the computer equivalent to identification information or the information memorized and its control approach, a storage, and a list at a computer program.

adio communication equipment which prevents interference of a wireless tag reader equipment which equips a wireless tag, and a wireless tag reader / writer ability and its control approach, a storage, and a list at a computer program, and relates to the reader / writer are intermingled in the same radio area and its control approach, a / writers in the environment where two or more wireless tags, and a wireless tag [0002] Furthermore, in detail, this invention relates to the radio communication storage, and a list at a computer program.

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PRIOR ART

carrying-out prevention system in dealers, such as a system of tariff liquidation in the [Description of the Prior Art] The radio frequency identification unit (wireless tag) of current and a non-contact mold is used by many systems, such as an unapproved system which manages close leaving, the goods discernment system in the PD, a dining-room, etc., CD, and software.

information of a proper, or the storage region which can be written, and it is by reading the information which has the operating characteristic which sends the electric wave [0004] A wireless tag can specify what it is a device including the identification

equivalent to identification information or the information memorized, and is written in identification information and the storage region of a wireless tag, distinction of goods, an owner's distinction, etc. can be performed using ID of a proper and the information the identification information and the storage region of a wireless tag by the reader which answers having received the electric wave of a specific frequency and is side. Therefore, in the system using the information currently written in the on other which are written in.

reception and a memory function, the driving source of this chip, and an antenna, and needed and it can supply outside on radio through an antenna. Therefore, it is possible [0006] By the way, in the same radio area, the equipment with which such wireless tag system performs reading or the writing to a wireless tag fundamentally is designed on the assumption that there is only one. For this reason, under the environment where wireless tags may answer, or two or more wireless tag reader / writers may try access antenna and accumulating that output in memory, the data in memory can be read if two or more wireless tags, and a wireless tag reader / writer are intermingled in the [0007] For example, to access from one a wireless tag reader / writer, two or more transmitting various data about goods etc. to the receiving means of IC chip via an is manufactured small. While according to this radio frequency identification unit to check existence of goods etc. and a location quickly and easily, or to pursue. [0005] For example, it is indicated by JP,6-123773,A about the radio frequency dentification unit which package-izes IC chip equipped with transmission and same radio area, it interferes each other and good radio cannot be performed. to the same wireless tag.

solve the problem of colliding mutually A tag with a different bitwise response from the response as which bitwise was determined beforehand is deactivated (deactivate). By answering appeal from one RF/ID reader, in order that two or more RF/ID tags may avoidable by making the wireless tag which the reader/writer of a wireless tag does [0009] The problem that the response from a wireless tag will interfere mutually is activating alternatively a tag with the response as which bitwise was determined beforehand (activate), it is indicated about the approach and equipment for a RF [0008] for example, in the ** table No. 513841 [2000 to] official report When discernment tag which are clearly obtained from two or more tags.

not make the partner of access be deactivated or sleep as proposed in this official

mentioned above], even if the situation in which a wireless tag will be in sleeping and [0010] However, case [like a wireless tag with a reader/writer function which was

a response interferes each other is avoidable, the problem that the demand from the reader/writer function will interfere with other reader/writers is still left behind. [0011] Probably, the problem of interference of the communication link in such same radio area is applied also in a well-known IC card and IC card reader/writer as non-contact communication system. An IC card communicates by applying amplitude modulation to the signal which appears in the receiving circuit of reader/writer by changing the load between own antennas according to the reply signal over the question signal from reader/writer.

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EFFECT OF THE INVENTION

[Effect of the Invention] As a full account was given above, according to this invention, the outstanding radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized and its control approach, a storage, and a list can be provided with a computer program.

[0100] Moreover, according to this invention, the outstanding radio communication equipment which equips the both sides of a wireless tag, and a wireless tag reader / writer ability, and operates suitably in radio area and its control approach, a storage, and a list can be provided with a computer program.

[0101] Moreover, according to this invention, the outstanding radio communication

equipment which can prevent interference of a wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list can be provided with a computer program.

[0102] According to this invention, in the radio communications system which serves as a wireless tag from a wireless tag reader / writer, wireless tag R/W equipment itself can carry out behavior as a wireless tag to the demand from other wireless tag Ra/W equipments by adding a function equivalent to a wireless tag to a wireless tag reader / writer, Moreover, when a sleep demand is received from external wireless tag reader / writer, forbidding the passive signal transmission in a wireless tag can be interlocked with, and interference of a mutual demand signal with other wireless tag reader writers can be mitigated by forbidding the active signal transmission in a wireless tag reader / writer.

[0103] Furthermore, according to this invention, since the above-mentioned effectiveness is acquired without adding modification to especially the wireless specification between a wireless tag, and a wireless tag reader / writer, mounting cost can be reduced sharply.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The purpose of this invention is to provide the outstanding radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends

the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized and its control approach, a storage, and a list with a computer program.

[0013] The further purpose of this invention is to provide with a computer program the outstanding radio communication equipment which equips the both sides of a wireless tag, and a wireless tag reader / writer ability, and operates suitably in radio area and its control approach, a storage, and a list.

[0014] The further purpose of this invention is to provide with a computer program the outstanding radio communication equipment which can prevent interference of a wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list.

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OPERATION

[Means for Solving the Problem and its Function] This invention is made in consideration of the above-mentioned technical problem. The 1st side face With the passive communications department which is the radio communication equipment which transmits and receives wireless data, and returns the reply signal over this while receiving the demand signal from the outside Having the active communications department which receives the reply signal over this, while transmitting a demand signal outside, said passive communications department is a radio communication

equipment characterized by the thing answer having received the sleep demand signal, apse into sleeping, and it stops answering a demand signal for from the outside.

[0016] With moreover, the passive communications department which returns the reply signal over this while the 2nd side face of this invention receives the demand signal over this while the active communications department which receives the reply signal over this while transmitting a demand signal outside. It is the control approach of the radio communication equipment which transmits and receives wireless data, and is the control approach of the radio communication equipment characterized by what it has for the step to which answer having received the sleep demand signal, and said passive communications department lapses into sleeping, and stops answering a demand signal from the outside.

[0017] According to the radio communication equipment concerning the 1st or 2nd side face of this invention, or its control approach, even if it is a case so that two or more radio communication equipments may be intermingled in the same radio area, the reply signal from two or more passive communications departments which receive the same demand signal can interfere, and a certain thing can be avoided.

[0018] Said passive communications department cancels sleeping according to having received the sleep discharge demand signal by sleeping, and the response to the demand signal from the outside is resumed.

[0019] Moreover, as for said active communications department, transmission of a demand signal is forbidden for said passive communications department between sleeping. Therefore, even if it is a case so that two or more radio communication equipments may be intermingled in the same radio area, the demand signal from the mutual active communications department can interfere, and a certain thing can be avoided.

[0020] Here, said active communications department can constitute as a wireless tag reader which modulates a demand signal and is sent out as an electric wave of predetermined transmit frequencies. Moreover, said passive communications department can constitute as a wireless tag which recognizes the demand signal received from the outside in the state of non-contact.

[0021] That is, the wireless tag reader itself can carry out behavior as a wireless tag to the demand from other wireless tag readers by adding a function equivalent to a wireless tag to a wireless tag reader. In such a case, when a sleep demand is received from an external wireless tag reader, the radio communication equipment concerning the 1st side face of this invention can be interlocked with forbidding the passive signal transmission in a wireless tag, and can mitigate interference of a demand signal among

other wireless tag readers by forbidding the active signal transmission in a wireless tag reader,

[0022] Or said active communications department can constitute as an IC card reader which receives a reply signal, applying a modulation to the signal which appears according to the load effect between the antennas in said passive communications department. Moreover, said passive communications department can constitute as an IC card to which the load between own antennas is changed according to the reply signal over the demand signal from the outside.

lapses into sleeping, and is answered and made into a demand signal from the outside, The step which said passive communications department cancels sleeping and makes computer system which can perform various program codes, for example. Attachment MO (Magneto-Optical disc), etc., etc., are free for such a medium, and it is a storage of portability. Or it is also technically possible to provide specific computer system with equipped with the active communications department which receives the reply signal received the sleep discharge demand signal, Said passive communications department and detachment of DVD (Digital Versatile Disc), CD (Compact Disc), FD (FloppyDisk), card, and can mitigate interference of a demand signal among other IC card readers by [0025] The storage concerning the 3rd side face of this invention is a medium which invention can be interlocked with forbidding the passive signal transmission in an IC is the storage characterized by providing the step which forbids transmission of the computer software via transmission media, such as a network (for a network not to computer-readable format. The step which it answers that said computer software reply signal over this while the 3rd side face of this invention receives the demand [0024] With moreover, the passive communications department which returns the [0023] In such a case, when a sleep demand is received from an external IC card resume the response to the demand signal from the outside according to having offers computer software in a computer-readable format to the general purpose received the sleep demand signal, and said passive communications department reader, the radio communication equipment concerning the 1st side face of this over this while transmitting a demand signal outside on computer system in the signal from the outside It is the storage which stored physically the computer software described to perform control of the radio communication equipment demand signal by said active communications department between sleeping. forbidding the active signal transmission in an IC card reader. ask distinction of wireless and a cable), etc.

0026] The storage concerning the 3rd side face of this invention defines the

in computer system through the storage concerning the 3rd side face of this invention. realizing the function of computer software predetermined in a computer system top, or a function. If it puts in another way, by installing predetermined computer software signal from the outside It is the computer program described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system. The step which it answers having received the sleep demand signal communications department cancels sleeping and makes resume the response to the collaboration-relation on the structure of the computer software and the storage for operation effectiveness as the radio communication equipment concerning each 1st characterized by providing the step which forbids transmission of the demand signal and said passive communications department lapses into sleeping, and is answered reply signal over this while the 4th side face of this invention receives the demand demand signal, Said passive communications department is the computer program [0027] With moreover, the passive communications department which returns the demand signal from the outside according to having received the sleep discharge of this invention] and 2nd side faces or its control approach can be acquired. on computer system, a collaboration-operation is demonstrated and the same and made into a demand signal from the outside, The step which said passive by said active communications department between sleeping.

[0028] The computer program concerning the 4th side face of this invention defines the computer program described to realize processing predetermined in a computer system top in the computer-readable format. If it puts in another way, by installing the computer program concerning the 4th side face of this invention in computer system, on computer system, a collaboration-operation is demonstrated and the same operation effectiveness as the radio communication equipment concerning each 1st [of this invention] and 2nd side faces or its control approach can be acquired. [0029] The purpose, the description, and advantage of further others of this invention will become [rather than] clear by detailed explanation based on the operation gestalt and the drawing to attach of this invention mentioned later.

[Embodiment of the Invention] Hereafter, it explains in detail about the operation gestalt of this invention, referring to a drawing.

[0031] The situation of radio area which realized this invention is shown in <u>drawing 1</u>. In this radio area, two or more reader writer equipments are intermingled in two or more wireless tags and a list. In this drawing, reference numbers 1 and 2 are wireless

tags, and reference numbers 3 and 4 are a wireless tag reader / writer. Hereafter, when you only call it "a wireless tag reader / writer", suppose that it is the radio communication equipment equipped with a wireless tag and the both sides of a reader/writer function.

[0032] In the example shown in <u>drawing 1</u>, read-out or a write request is transmitted to the wireless tags 1 and 2 with which a wireless tag reader / writer 3 exists in the same radio area, and a list to a wireless tag reader / writer 4, and signs that the response is received are shown. In this case, if it sees from a wireless tag reader / writer 3, a wireless tag reader / writer 4 will act like the wireless tags 1 and 2. That is, a wireless tag reader / writer 3 also recognizes a wireless tag reader / writer 4 as one of the wireless tags.

[0033] Furthermore, in the example shown in this drawing, in order to mitigate the interference to a wireless tag reader / writer 3, the wireless tag reader / writer 4 has controlled sending out a sending signal active as reader/writer.

[0034] The hardware configuration of the radio communication equipment 100 equipped with the function of a wireless tag and the both sides of reader/writer is typically shown in <u>drawing 2</u>. Hereafter, each part is explained, referring to this drawing.

[0035] A reference number 101 is a non-volatile storage region, for example, consists of nonvolatile memory equipment in which writing like EEPROM (Electrically Erasable and Programmable ROM) is possible, and external storage like hard disk equipment. This non-volatile storage region 101 is equipped with the usable storage region general-purpose [the control-software storing field holding the program code for controlling actuation of a radio communication equipment 100, the virtual tag storage region used when a radio communication equipment 100 acts as a wireless tag (or other passive communication devices), and others].

[0036] A reference number 102 is a display with an output screen, for example, consists of liquid crystal display displays (LCD), and it is used in order to display actuation of a radio communication equipment 100 and a condition.

[0037] A reference number 103 is CPU (Central Processing Unit) which controls actuation of the radio-communication-equipment 100 whole in generalization.

Moreover, a reference number 104 is temporary storage 104, and consists of volatile memory equipment in which rewriting like RAM (Random Access Memory) is possible.

CPU103 performs the program code loaded on temporary storage 104 from the control-software storing field of the non-volatile storage region 101, and saves the activity data under program execution in temporary storage 104 temporarily.

[0038] A reference number 105 is the input section for a user to input an actuation command, data, etc. The input section 105 consists of two or more keys, a carbon button, or a touch panel on which the display screen of a display 102 was overlapped. [0039] A reference number 106 is the Radio Communications Department, is a functional module which performs the exterior and radio according to the command from CPU103, and is equipped with RF block which transmits and receives the baseband block which manages transmission and reception of a signal, and predetermined RF signalling frequency through an antenna 107. The Radio Communications Department 106 can consist of general-purpose logic devices like FPGA (Field Programmable Gate Array) into which a user can change internal logic by the program after IC completion.

[0040] With this operation gestalt, the Radio Communications Department 106 has the passive communication facility which receives the demand signal from the outside and returns a reply signal, and the active communication facility which receives the reply signal from the exterior while transmitting a demand signal outside. However, the after-mentioned is yielded about these details.

[0041] A reference number 108 is an external interface, and it can be used in order to connect a radio communication equipment 100 with a computer, other information machines and equipment, and an information processing terminal. An external interface is Ethernet, RS232C, and USB (Universal Serial Bus), IrDA, Bluetooth and IEEE. It can constitute from standard interfaces, such as 802.11b.

[0042] The functional configuration of the Radio Communications Department 106 is typically shown in <u>drawing 3</u>. As shown in this drawing, it has passive communications department 106A which receives the demand signal from the outside and returns a reply signal, and active communications department 106B which receives the reply signal from the exterior while transmitting a demand signal outside.

[0043] Passive communications department 106A can be read from the exterior, and can receive demand signals, such as a demand, and a sleep demand besides a write request, a sleep discharge demand. When a read-out demand is received, a letter is answered in the requested data stored in the virtual tag storage region of the non-volatile storage region 101. Moreover, when a write request is received, requested data is written in the virtual tag storage region of the non-volatile storage

[0044] Moreover, passive communications department 106A answers having received the sleep demand, and lapses into sleeping. It stops answering a read-out demand and a write request from the outside in sleeping. For example, when two or more passive

communications department 106A in the same radio area is intermingled, the problem that the response from passive communications department 106A will interfere mutually can be avoided by setting it except specific passive communications department 106A as sleeping. Sleeping is continued until it receives a sleep discharge demand and sleep is canceled.

[0045] Passive communications department 106A holds any of an own condition, i.e., sleeping, or a sleep discharge condition they are to condition attaching part 106C. Active communications department 10B can access condition attaching part 106C of passive communications department 106A.

[0046] One active communications department 106B can receive the reply signal over this while it is read outside and transmits demand signals, such as a demand, and a sleep demand besides a write request, a sleep discharge demand. By transmitting a sleep demand, the sleeping can be canceled by making the other party's passive communications department 106A change to sleeping, and transmitting a sleep discharge demand.

[0047] Active communications department 10B distinguishes whether passive communications department 106A is sleeping with reference to condition attaching part 106C in passive communications department 106A, before transmitting a demand signal. And if it is sleeping, sending out of a demand signal will be disabled, this — for example, when two or more active communications department 10B is intermingled in the same radio area, the problem that a demand signal will interfere mutually can be avoided.

[0048] A wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency as an example of the combination of passive communication facility and active communication facility, and is equivalent to identification information or the information memorized, and a wireless tag reader / writer can be mentioned. [0049] Here, the structure to which the wireless tag reader / writer as the active communications department carry out R/W actuation to the wireless tag as the passive communications department is explained, referring to <u>drawing 4</u>. a wireless transmission and reception in the example of illustration sake — electromagnetism — the transfer method is adopted.

[0050] In this drawing, a reference number 11 is a wireless tag and consists of a tag chip 12 and an antenna 13.

[0051] The dipole antenna of the half-wave length etc. is used for an antenna 13. Moreover, the tag chip 12 consists of the modulation section 20, the rectification /

recovery section 22, and the memory section 23. The memory section 23 is equivalent to a virtual tag storage region (above-mentioned).

[0052] It is received by the antenna 13 and the electric wave fo transmitted from the wireless tag reader / writer 10 is inputted into rectification / recovery section 22. Here, a recovery function carries out initiation of operation according to this power source, and it is recognized that it is a reading signal over the wireless tag 11 at the same time an electric wave fo is rectified and it is changed into DC power supply. The generated power source is supplied also to the memory section 23 and the modulation section 20.

[0053] The memory section 23 reads information, such as ID beforehand stored in the interior, and sends it to the modulation section 20 as transmit data. The modulation section 20 consists of diode switches 21, and a diode switch 21 repeats ON / off actuation with transmit data. That is, when data are 1, it becomes ON and termination of the antenna 13 is carried out with an antenna impedance (for example, 50 ohms). [0054] At this time, the electric wave from a wireless tag reader / writer 10 is absorbed by the wireless tag 11 side. When data are 0, it becomes off, and a diode switch 21 will be in an opening condition, and the termination of an antenna 13 will also be in an opening condition at coincidence. At this time, it will be reflected and the electric wave from a tag reader / writer 10 will return to a transmitting agency. [0055] Such a correspondence procedure is called a "back-scatter method." In this way, the wireless tag 11 becomes possible [sending the information on internal to wireless tag reader / writer 10 side with a non-power source].

[0056] One wireless tag reader / writer 10 consist of antennas 15 connected to the tag reading module 14 and this tag reading module 14, and is used, connecting with the host device 16. The host device 16 consists of information terminals, such as CPU103 in a radio communication equipment 100, a personal computer further connected by external-interface 108 course, and PDA (Personal Digital Assistant), and offers a user interface for a user to perform a dialogue input.

[0057] The host device 16 notifies reading directions of the wireless tag 11 to the communications control section 30 via the host interface section 31 first.
[0058] The baseband processing section 29 sends baseband signaling to the ASK (Amplitude Shift Keying) modulation section 27, after filtering by editing into transmit data, if the reading command of the tag from the communications control section 30 is received. The ASK modulation section 27 performs an ASK modulation on the frequency fo of a frequency synthesizer 26.

[0059] The frequency setting of a frequency synthesizer 26 is performed by the

communications control section 30. Generally, for mitigation of the standing wave of the signal from the wireless tag 11, or a multi-pass, the hopping of the transmit frequencies to the wireless tag 11 is carried out, and they are used. Directions of this hopping are also performed by the communications control section 30. The sending signal to which the ASK modulation was applied is emitted towards the wireless tag 11 via a circulator 24 from an antenna 15.

10060] As stated previously, the reflective signal from the wireless tag 11 which has returned by the back-scatter method is the same frequency as the signal transmitted from the wireless tag reader / writer 10. It is received by the antenna 15 of a wireless tag reader / writer 10, and this signal is inputted into a mixer 25.

[0061] Since the same local frequency fo as the time of transmission is inputted into a nixer 25, in the output of a mixer 25, the signal to which the modulation was applied by the wireless tag 11 side will appear.

[0062] In the recovery section 28, it recovers from this signal to the data of 1/0, and sends to the baseband processing section 29. In the baseband processing section 29, data are decoded and the data stored in the memory section 23 in the wireless tag 11 are taken out. This data is transmitted to the host device 16 from the host interface section 31 according to directions of the communications control section 30. [0063] A wireless tag reader / writer 10 can read the information in the wireless tag

[0063] A wireless tag reader / writer 10 can read the information in the wireless tag 11 as mentioned above. Moreover, a wireless tag reader / writer 10 can perform write-in actuation to the wireless tag 11 in the same actuation as ****. In this case, the the data by the side of the host device 16 can be written in the memory section 23 (namely, virtual tag storage region) in the wireless tag 11.

[0064] Moreover, IC card reader/writer can be mentioned to the noncontact IC card list which communicates by applying amplitude modulation to the signal which appears in the receiving circuit of reader/writer by changing the load between own antennas according to the reply signal over the demand signal from reader/writer as other examples about the combination of passive communication facility and active communication facility.

[0065] Radio between an IC card and IC card reader/writer is realized based on the principle of electromagnetic induction. In <u>drawing 5</u>, the structure of the radio of an IC card and IC card reader/writer based on electromagnetic induction is illustrated notionally. IC card reader/writer is equipped with the antenna LRW which consisted of loop-formation coils, and a field is generated by passing Current IRW at this antenna LRW around it. On the other hand, the loop-formation coil Lc is electrically made with the IC card side around the IC card. In the loop-formation coil Lc edge by the side of

an IC card, the induced voltage by the field which the loop antenna Lc by the side of IC card reader/writer emits arises, and it is inputted into the terminal of the IC card connected to the loop-formation coil Lc edge.

relationship, the loop-formation coil Lc by the side of the antenna LRW by the side of C card reader/writer and an IC card can be caught if one transformer is formed as a Antenna LRW, the electrical potential difference VO by which induction is carried out [0068] Moreover, an IC card has the function (Load Switching) to fluctuate the load appear. By restoring to a part for this fluctuation, IC card reader/writer can receive loop-formation coil Lc is changed, in an IC card reader/writer side, the impedance between antenna terminals changes, and it will become fluctuation of the passage [0067] At an IC card reader/writer side, in modulating the current IRW passed at current IRW of Antenna LRW, or an electrical potential difference VRW, and will system, and as shown in drawing 6, it can model R/W actuation of an IC card. to the loop-formation coil Lc on IC chip can receive a modulation, and IC card between the terminals of the loop-formation coil Lc according to the data for .0066] Although the degree of coupling changes according to mutual physical returning IC card reader/writer. If the load between the terminals of the reader/writer can perform data transmission to an IC card using that. the return data of an IC card.

[0069] Namely, an IC card can communicate by applying amplitude modulation to the signal which appears in the receiving circuit by the side of card R/W equipment by changing the load between own antennas according to the reply signal over the demand signal from IC card reader/writer.

[0070] In the form of the flow chart shows the signal reception actuation in a radio communication equipment 100 to <u>drawing 7</u>. A radio communication equipment makes possible behavior as passive communication facility like the usual wireless tag (or IC card), and this actuation is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the signal reception in a radio communication equipment 100 is explained, referring to this flow chart.

chart. [0071] If signal reception starts in a radio communication equipment 100, in step S1,

10071 If signal reception starts in a radio communication equipment 100, in step S1, sleeping will be initialized off first. And it will be in the condition of the waiting for signal reception at step S2 after this.

0072] In a signal receiving waiting state, if a radio communication equipment 100

receives a reply signal from passive communication facility, such as an external wireless tag (or IC card), or receives a demand signal from active reception functions, such as a wireless tag reader / writer (or IC card reader/writer), it will progress to step S3 and sleeping will be judged.

[0073] In the decision block S3, when judged with sleeping being ON, it progresses to step S4 and judges whether the signal received further is a sleep discharge demand. In the case of signals other than a sleep discharge demand, the radio communication equipment 100 during sleep waits for return and the next signal reception to step S2, without processing anything.

[0074] On the other hand, when judged with it being a sleep discharge demand in step S4, after progressing to degree step S5 and setting up sleeping off, it waits for return and the next signal reception to step S2.

[0075] If processing in step S5 is performed, sleeping is canceled, and this radio communication equipment 100 will be in the condition that various demands as a wireless tag reader / a writer (or IC card reader/writer) can be transmitted while being in the condition that it can answer to various demands as passive communication facility, such as a wireless tag (or IC card).

[0076] Moreover, in the decision block S3, when judged with sleeping being off, the signal progressed and received to step S6 judges whether it is a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), or it is a reply signal from passive communication facility, such as other wireless tags (or IC card).

[0077] In the decision block S6, when judged with it being a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), it progresses to step S7 and judges whether an input signal is a sleep demand further.

[0078] When judged with it being a sleep demand in the decision block S7, after setting sleeping as ON in a degree S8, it waits for return and the next signal reception to step

[0079] If step S8 is processed, this radio communication equipment 100 will not transmit various demands as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer), while stopping answering to various demands as passive communication facility, such as a wireless tag (or IC card), until sleeping is canceled.

[0080] Moreover, in the decision block S7, when judged with an input signal being except a sleep demand, it progresses to step S10 and the Radio Communications

Department 106 performs, the behavior, i.e., the demand reception, as passive communication facility, such as a wireless tag (or IC card). Then, it waits for return and the next signal reception to step S2. <u>Drawing 9</u> explains the demand reception in step S10 separately on the relation of space.

[0081] When it judges that an input signal is not a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), in the decision block S6, namely, when judged with it being a reply signal from passive communication facility, such as other wireless tags (or IC card) It progresses to step S9 and performs, the behavior, i.e., the response reception, as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer). Then, it waits for return and the next signal reception to step S2.

Drawing 8 explains the response reception in step S9 separately on the relation of

[0082] In the form of the flow chart shows the procedure of the response reception in step 9 in the flow chart shown in <u>drawing 7</u> to <u>drawing 8</u>. As for this response reception, a radio communication equipment 100 is equivalent to the behavior as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer). This response reception is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the response reception of a radio communication equipment 100 is explained, referring to

[0083] A radio communication equipment 100 creates a response result after reply signal reception initiation, returns processing to the procedure of call origin (step S21), and ends response reception.

[0084] Moreover, in the form of the flow chart shows the procedure of the demand reception in step 10 in the flow chart shown in <u>drawing 7</u> to <u>drawing 9</u>. As for this demand reception, a radio communication equipment 100 is equivalent to the behavior as passive communication facility, such as a wireless tag (or IC card). This demand reception is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the demand reception of a radio communication equipment 100 is explained, referring to this flow chart.

[0085] First, in step S31, it distinguishes whether the demand which received is ID

discernment demand. In being ID discernment demand, it progresses to step S32 and performs ID discernment processing. ID discernment processing is reading ID which passive communication facility's, such as this wireless tag's, has. With this operation gestalt, ID is read from the inside of the virtual tag storage region of the non-volatilized storage region 101, and it is sent out to a requiring agency. [0086] Moreover, if the demand which received is not ID discernment demand, subsequently in step S34, it will distinguish whether it is a write request. In being a write request, it progresses to step S35 and performs write-in processing. It is writing the demanded information in the demanded location to the virtual tag storage region in the non-volatilized storage region 101 indicated to be write-in processing in this operation gestalt to <u>drawing 2</u>.

[0087] Moreover, if the demand which received is not a write request, subsequently in step S36, it will distinguish whether it is a read-out demand. In being a read-out demand, it progresses to step S37 and performs read-out processing. It is reading in the demanded size from the location of which the information currently held in the virtual tag storage region in the non-volatilized storage region 101 indicated to be read-out processing in this operation gestalt to <u>drawing 2</u> was required.
[0088] After processing the demand which these-received, a reply signal is transmitted to a requiring agency at step S33, and this whole manipulation routine is ended.

[0089] Moreover, in the form of the flow chart shows procedure for a radio communication equipment 100 to perform signal transmitting processing to drawing.

10. According to this procedure, in case it acts as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer), transmitting processing of an active demand signal is restricted according to the condition (that is, is it sleeping or not?) of passive communication facility, such as a wireless tag (or IC card).

[0090] This procedure is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the signal transmitting processing in a radio communication equipment 100 is explained, referring to this flow chart.

[0091] In case a radio communication equipment 100 transmits various demand signals by actuation of the control software stored in the non-volatilized storage region 101, it distinguishes first whether passive communication facility section 106A, such as a wireless tag (or IC card), is sleeping in step S41.

[0092] Since there is no fear of a demand signal interfering mutually among other radio communication equipments when judged with it not being sleeping, it progresses to step S42 and demand signal transmission is performed as it is.

[0093] On the other hand, in the decision block S41, when judged with passive communication facility section 106A, such as a wireless tag (or IC card), being sleeping, in order to restrict signal transmission and to avoid interference with other demand signals, it progresses to step S43, under sleep is set as a response result, and this manipulation routine is ended.

[0094] The demand signal used for the following table 1 between the radio communication equipments which consist of a wireless tag and wireless tag reader writer equipment is packed. The radio communication equipment 100 in the operation gestalt of this invention mentioned above needs to have at worst the function in which these demand signals can be transmitted. About the demand signal except having been shown here, addition and modification of may be done if needed.

Table 1]

교구점	NA 18
I D識別要求	周囲の無償タグ、無¢タグリーダ・ライタ装置が持つ IDを取得するための要求信号。
スリーブ要求	周囲の無線タグ、無線タグリーダ・ライタ装置に対し てスリーブ状態にさせるための要求信号。
スリーブ解除要求	周囲の無線タグ、無線タグリーダ・ライタ装置に対し てスリーブ状態を解除させるための要求信号。
書き込み要求	周囲の無線タグ、無線タグリーダ・ライタ装置に対し て情報を書き込むための要求信号。
読み出し要求	周囲の無緯タグ、無緯タグリーダ・ライタ装置から情報を読み出すための要求信号。

[0096] Moreover, the reply signal used for the following table 2 between the radio communication equipments which consist of a wireless tag and wireless tag reader writer equipment is packed. The radio communication equipment 100 in the operation form of this invention mentioned above needs to have at worst the function in which these reply signals can be transmitted. About the reply signal except having been shown here, addition and modification of may be done if needed.

[0097]

[Table 2]

信号名	内容
ID贈別応答	無輪タグ、無線タグリーダ・ライタ装置が待つIDを 要求元に返すための応答信号。
書き込み応答	無線タグ、無線タグリーダ・ライタ装置が持つ記憶領 域に情報を書き込んだ結果を返すための店客信号。
静み出し広答	無線タグ、無線タグリーダ・ライタ装置が持つ配億領 域から情報を読み出した結果を選すための店客信号。

[0098] It has explained in detail about this invention, referring to a specific operation gestalt more than [addenda]. However, it is obvious that this contractor can accomplish correction and substitution of this operation gestalt in the range which does not deviate from the summary of this invention. That is, this invention should not be indicated with the gestalt of instantiation, and the written contents of this specification should not be interpreted restrictively. In order to judge the summary of this invention, the column of the claim indicated at the beginning should be taken into consideration.

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

 $[\underline{\mathsf{Drawing}}\ 1]$ It is drawing having shown the situation of radio area which realized this invention.

[Drawing 2] It is drawing having shown typically the hardware configuration of the radio communication equipment 100 equipped with the function of a wireless tag and

the both sides of reader/writer.

[Drawing 3] It is the block diagram having shown the functional configuration of the Radio Communications Department 106 typically.

[Drawing 4] It is drawing for explaining the structure to which the wireless tag reader / writer as the active communications department perform R/W actuation to the wireless tag as the passive communications department.

[Drawing 5] It is drawing having shown notionally the structure of the radio of an IC card and IC card reader/writer based on electromagnetic induction.

Drawing 6] It is drawing which modeled R/W actuation of an IC card.

Drawing 7] It is drawing having shown the signal reception actuation in a radio

communication equipment 100 in the form of the flow chart.

[Drawing 8] It is the flow chart which showed the procedure of the response reception in step 9 in the flow chart shown in drawing 7.

[Drawing 9] It is the flow chart which showed the procedure of the demand reception in step S10 in the flow chart shown in drawing $\overline{7}$.

[Orawing 10] It is the flow chart which showed procedure for a radio communication equipment 100 to perform signal transmitting processing.

Description of Notations]

100 -- Radio communication equipment

101 -- Non-volatile storage region

102 -- Display

103 -- CPU

104 — Temporary storage

105 -- Input section

106 — Radio Communications Department

107 — Antenna

108 -- External interface

[Translation done.]

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damages caused by the use of this translation.

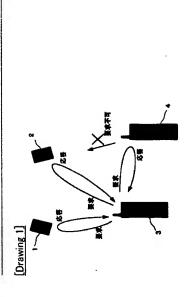
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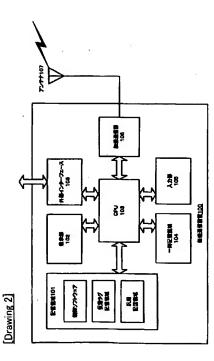
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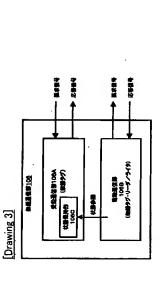
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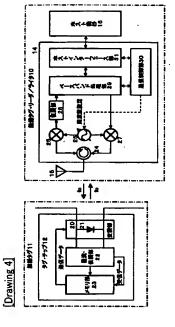
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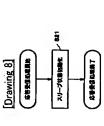
DRAWINGS

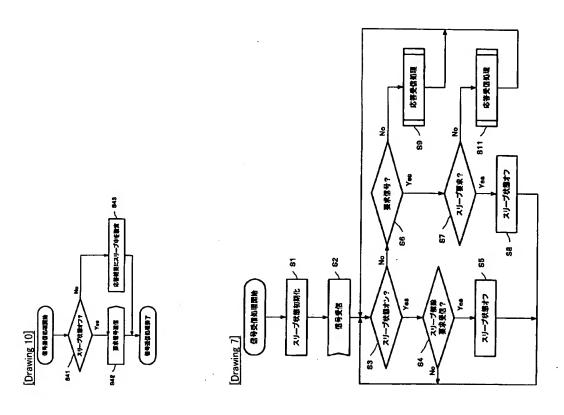


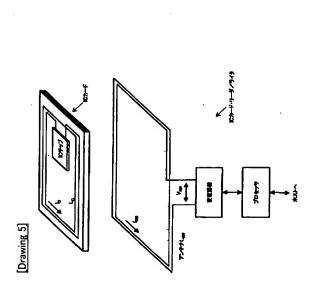


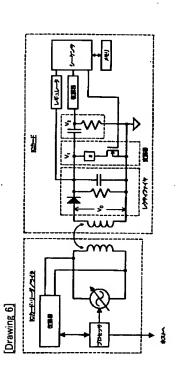


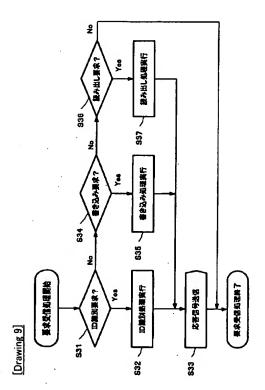












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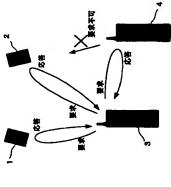
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無線通信装置及びその倒御方法、記憶媒体、並びにコンピュータ・プログラム (54) [発取の名称]

(21) [製約]

【課題】 無線タグ・リーダブライタ同士の干渉を防止

ブ要求を受信したときに、無線タグにおける受動的な信 【解決手段】 無線タグ・リーダ/ライタに無線タグと 同等の機能を付加することによって、無線タグ・リーダ / ライタ自体が他の無線タグ・リーダ/ライタからの要 求に対して無線タグとしての振る聴いをすることができ り、他の無線タグ・リーダ/ライタとの間で要求信号の る。また、外部の無線タグ・リーダブライタからスリー 号送信を禁止することに連動して、無線タグ・リーダ〜 ライタにおける能動的な信号送信も禁止することによ 干渉を軽減することができる。



特許語次の範囲】

【請求項1】無線データを送受信する無線通信装置であ

外部からの要求信号を受信するとともにこれに対する応 **答信号を返す受動通信部と**

外部に要求信号を送信するとともにこれに対する応答信 号を受信する能動通信部とを備え、

前記受動通信部はスリーブ要求信号を受信したことに応 答してスリーブ状態に陥って外部からの要求信号に応答

【請求項2】前記受動通信部はスリーブ解除要求信号を 受信したことに応じてスリーブ状態を解除して外部から の要求信号に対する応答を再開する、ことを特徴とする しなくなる、ことを特徴とする無線通信装置。

【精束項3】前配受動通信部がスリーブ状態の間、前記 情水項1に記載の無線通信装置。

能動通信部は要求信号の送信が禁止される、ことを特徴

【精永頃4】前記能動通信部は、要求信号を変調して所 **定の送信周波数の電波として送出する無線タグ・リーダ** とする請求項1に配載の無線通信装置。

前記受動通信部は、外部から受信した要求信号を非接触 **状態で認識する無級タグである、ことを特徴とする請求** 頃1に記載の無線通信装置。

ន

るアンテナ間の負荷変動に応じて現れる信号に変調をか 前記受動通信部は、外部からの要求信号に対する応答信 **导に広じて自身のアンテナ間の負荷を変化させる I Cカ** - ドである、ことを特徴とする請求項1に記載の無線通 【請求項5】前配能動通信部は、前記受動通信部におけ けて応答信号を受信するICカード・リーダであり、

れに対する応答信号を返す受動通信部と、外部に要求信 号を送信するとともにこれに対する応答信号を受信する **能動通信部とを備えて、無線データを送受信する無線通** 【請求項6】 外部からの要求信号を受信するとともにこ

スリープ要求信号を受信したことに応答して前記受動通 しなくなるステップを備える、ことを特徴とする無線通 **冒部がスリーブ状態に陥って外部からの要求信号に応答** 信装置の制御方法であって、

【請求項7】スリーブ解除要求信号を受信したことに応 こて前記受動通信部がスリーブ状態を解除して外部から の要求信号に対する応答を再開するステップをさらに備 信装置の制御方法。

ことを特徴とする請求項6に記載の無線通信装置の制御

【請求項8】前記受動通信部がスリーブ状態の間、前記 能動通信部による要求信号の送信を禁止するステップを さらに備える、ことを特徴とする請求項6に配截の無線 角信装置の制御方法。

S 【間次項9】前記能動通信部は、要求信号を変開して所

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定の送信周波数の電波として送出する無線タグ・リーダ **が配受動通信部は、外部から受信した要求信号を非接触**

状態で起題する無線タグである、ことを特徴とする間求 【請求項10】前配能動通信部は、前配受動通信部にお けるアンテナ間の負荷変動に応じて現れる信号に変調を 頁6に記載の無線通信装置の制御方法。

号に広じて自身のアンテナ間の負荷を変化させる1Cカ ードである、ことを特徴とする間求項6に記載の無粮通 前配受動通信部は、外部からの要求信号に対する応答信 かけて広答信号を受信するICカード・リーダであり 信装置の制御方法。

る能動通信部とを備えた無線通信装置の制御をコンピュ ータ・システム上で実行するように配述されたコンピュ ータ・ソフトウェアをコンピュータ可能形式で物理的に 格納した記憶媒体であって、前記コンピュータ・ソフト 【請求項11】外部からの要求信号を受信するとともに これに対する応答信号を返す受助通信部と、外部に要求 信号を送信するとともにこれに対する応答信号を受信す

信部がスリープ状態に陥って外部からの要求信号に応答 スリーブ要求信号を受信したことに応答して前配受動通 しなくするステップと、

スリープ解除要求信号を受信したことに応じて前記受動 通信部がスリープ状態を解除して外部からの要求信号に 対する広答を再開させるステップと、

前配受動通信部がスリーブ状態の間、前配能動通信部に よる要求信号の送信を禁止するステップと、を具備する ことを特徴とする配徴媒体。 【精求項12】外部からの要求信号を受信するとともに これに対する応答信号を返す受動通信部と、外部に要求 **扂号を送信するとともにこれに対する応答信号を受信す** る能動通信部とを備えた無線通信装置の制御をコンピュ **一タ・システム上で実行するように配述されたコンピュ**

スリーブ要求信号を受信したことに応答して前配受動通 目部がスリープ状態に陥って外部からの要求信号に応答 ータ・プログラムであって、 しなくするステップと、

スリーブ解除要求信号を受信したことに応じて前記受動 通信部がスリープ状態を解除して外部からの要求信号に 対する広答を再開させるステップと、 \$

よる要求信号の送信を禁止するステップと、を具備する **が記受動通信部がスリー才状態の間、前記能動通信部に** ことを特徴とするコンピュータ・プログラム。

【発明の属する技術分野】本発明は、比較的近距離の無 泉通信エリアで動作する無線通信装置及びその制御方

法、記憶媒体、並びにコンピュータ・プログラムに係り、例えば特定周波数の電波を受信したことに応答して

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る動作特性を持つ無線タグを用いて非接触通信を行う無 識別情報や記憶されている情報に相当する電波を発信す 狼通信装置及びその制御方法、配憶媒体、並びにコンピ ュータ・プログラムに関する。

いて無線タグ・リーダノライタ同士の干渉を防止する無 や無線タグ・リーダイライタが混在するような環境にお 【0002】更に詳しくは、本発明は、無線タグ及び無 **線タグ・リーダ/ライタ機能を装備する無線通信装置及** びその制御方法、記憶媒体、並びにコンピュータ・プロ ゲラムに係り、同じ無線通信エリア内に複数の無線タグ **泉通信装置及びその制御方法、記憶媒体、並びにコンピ** ュータ・プログラムに関する。

0003

テム、CDやソフトウエアなどの販売店での無断持ち出 おける物品額別システム、食堂などでの料金消算のシス (無線タグ) は、人退室を管理するシステムや、物流に 【従来の技術】現在、非接触型の無線周波数離別装置 し防止システムなど、多数のシステムで利用されてい 【0004】無粮タグは、固有の識別情報や読み魯き可 間額に相当する電波を発信する動作特性を持ち、読み取 ている情報を読み出すことによりそれが何であるかを特 定することができる。したがって、無限タグの識別情報 や記憶領域に書き込まれている情報を用いたシステムで 能な記憶領域を含んだデバイスであり、特定周波数の電 彼を受信したことに応答して顧別指報や記憶されている り装岡側で無線タブの識別情報や記憶領域に費き込まれ は、曹き込まれている固有の1Dやその他の情報を利用 して、物品の判別や所有者の判別などを行うことができ

がって、物品などの存在や位置を迅速且つ容易に確認し は、送受信及びメモリ機能を備えた1Cチップと、該チ 手段に送信し、その出力をメモリに蓄積しておくととも テナを介して無線で外部に供給することができる。した ップの駆動痕と、アンテナとをパッケージ化して小型に る。この無線周波数識別装置によれば、物品などに関す るさなざなのデータをアンテナ経由で1 (チップの受信 に、必要に応じてメモリ内のデータを読み出して、アン 【0005】例えば、特開平6-123773号公報に 製作される無線周波数離別装置について開示されてい たり追跡することが可能である。

【0006】ところで、このような無線タグ・システム 装置は同じ無税通信エリア内では1つしかないことを前 **堪にして設計されている。このため、同じ無線通信エリ** ア内に複数の無線タグや無線タグ・リーダブライタが混 在するような環境下では、互いに干渉し合い、良好な無 は基本的に、無粮タグへの競み取り又は杳き込みを行う 線通信を行うことができない。

2 からのアクセスに対して複数の無線タグが応答してしま 【0007】例えば、1つの無線タグ・リーダ/ライタ

[0015]

ったり、同じ無線タグに対して複数の無線タグ・リーダ / ライタがアクセスを試みてしまったりする可能性があ

うという問題を解決するために、ビットワイズのあらか じめ定められた応答とは異なるビットワイズ応答を持つ ワイズのあらかじめ定められた応答を持つタグを選択的 複数のタグから明瞭に得られるようにする、髙周波麟別 【0008】例えば、特表2000-513841号公 タグを非活性化 (deactivate) して、ピット 独には、1つのRF/1Dリーダからの呼び掛けに応答 するときに複数のRF/IDタグが互いに衝突してしま に活性化 (activate) させておくことにより、

【0009】同公報で提案されているように、無線タグ のリーダ、デライタがアクセスの相手としない無線タグを 非活性化又はスリープさせることにより、無線タグから の応答が互いに干渉してしまうという問題を回避するこ タグのための方法及び装置について開示されている。 とができる。

たとしても、そのリーダノライタ機能からの要求が他の 【0010】ところが、上述したようなリーダ/ライタ 機能付き無線タグのような場合、無線タグはスリーブ状 **態となって広答が干渉し合う事態を回避することができ** リーダ/ライタと干渉してしまうという問題が依然とし て残されている。

通信の干渉の問題は、非接触通信システムとして周知の 間の負荷を変化させることによってリーダ/ライタの受 【0011】このような同じ無線通信エリア内における 1 Cカード及び1 Cカード・リーダ/ライタにおいても 当て嵌まるであろう。1Cカードは、リーダノライタか らの質問信号に対する応答信号に応じて自身のアンテナ **信回路に現れる信号に振幅変調をかけて通信を行う。**

【発明が解決しようとする課題】本発明の目的は、特定 周波数の電波を受信したことに応答して識別情報や記憶 されている情報に相当する電波を発信する動作特性を持 つ無線タグを用いて非接触通信を行う、優れた無線通信 **装置及びその制御方法、配億媒体、並びにコンピュータ** プログラムを提供することにある。 [0012]

【0013】 本発明の更なる目的は、無線タグ及び無線 リア内で好適に動作する、優れた無線通信装置及びその 制御方法、記憶媒体、並びにコンピュータ・プログラム タグ・リーダ/ライタ機能の双方を装備して無線通信エ を提供することにある。

【0014】本発明の更なる目的は、同じ無線通信エリ ア内に複数の無線タグや無線タグ・リーダ/ライタが混 在するような環境において無線タグ・リーダ/ライタ同 士の干渉を防止することができる、優れた無線通信装置 及びその制御方法、記憶媒体、並びにコンピュータ・プ ログラムを提供することにある。

部からの要求信号を受信するとともにこれに対する応答 とに広答してスリープ状態に陥って外部からの要求信号 【親題を解決するための手段及び作用】本発明は、上記 は、無線データを送受信する無線通信装置であって、外 信号を返す受動通信部と、外部に要求信号を送信すると ともにこれに対する応答信号を受信する能動通信部とを に応答しなくなる、ことを特徴とする無線通信装置であ 備え、前記受動通信部はスリーブ要求信号を受信したこ **限題を参酌してなされたものであり、その第1の側面**

することができる。

て、スリープ要求信号を受信したことに応答して前記受 [0016]また、本発明の第2の側面は、外部からの 要求信号を受信するとともにこれに対する応答信号を返 無線データを送受信する無線通信装置の制御方法であっ 別通信部がスリーブ状態に陥って外部からの要求信号に **巧答しなくなるステップを悩える、ことを特徴とする無** す受動通信部と、外部に要求信号を送信するとともにこ れに対する応答信号を受信する能動通信部とを備えて、 線通信装置の制御方法である。

[0017] 本発明の第1又は第2の側面に係る無線通 信装置又はその制御方法によれば、、複数の無線通信装 団が同じ無線通信エリア内に混在するような場合であっ ても、同じ要求信号に対する複数の受動通信部からの応 【0018】 前記受動通信部は、スリーブ状態でスリー 答信号が干渉しあることを回避することができる。

間、前記能動通信部は要求信号の送信が禁止される。し **プ解除要求信号を受信したことに応じてスリープ状態を** 解除して、外部からの要求信号に対する応答を再開する たがって、複数の無線通信装置が同じ無線通信エリア内 【0019】また、前記受動通信部がスリープ状態の ようになっている。

に電在するような場合であっても、互いの能動通信部か

らの要求信号が干渉しあることを回避することができ

【0020】ここで、前記能動通信部は、要求信号を変 ・リーダとして構成することができる。また、前記受動 通信部は、外部から受信した要求信号を非接触状態で認 関して所定の送信周波数の電波として送出する無線タグ **誰する無線タグとして構成することができる。**

【0021】すなわち、無線タグ・リーダに無線タグと 自体が他の無線タグ・リーダからの要求に対して無線タ ゲとしての振る舞いをすることができる。このような場 合、本発明の第1の側面に係る無線通信装置は、外部の 禁止することによって、他の無線タグ・リーダとの間で 同等の機能を付加することによって、無線タグ・リーダ 無線タグにおける受動的な信号送信を禁止することに連 動して、無線タグ・リーダにおける能動的な信号送信も 無線タグ・リーダからスリープ要求を受信したときに、 **要求信号の干渉を軽減することができる。**

S 【0022】あるいは、前配能動通信部は、前配受動通

は、外部からの要求信号に対する応答信号に応じて自身 信部におけるアンテナ間の負荷変動に応じて現れる信号 に変調をかけて広答信号を受信する1Cカード・リーダ のアンテナ間の負荷を変化させる1 Cカードとして構成 として構成することができる。また、前配受助通信部

て、他のICカード・リーダとの間で要求信号の干渉を 【0023】このような場合、本発明の第1の側面に係 **ープ要求を受信したときに、ICカードにおける受動的** な信号送信を禁止することに連動して、1Cカード・リ る無線通信装置は、外部のICカード・リーダからスリ 一ダにおける能動的な信号送信も禁止することによっ

怪滅することができる。

[0024]また、本発明の第3の側面は、外部からの れに対する広答信号を受信する能動通信部とを備えた無 要求信号を受信するとともにこれに対する応答信号を返 **す受動通信部と、外部に要求信号を送信するとともにこ** るように記述されたコンピュータ・ソフトウェアをコン **娘通信装置の制御をコンピュータ・システム上で実行す** ຣ

求信号の送信を禁止するステップと、を具備することを て前記受動通信部がスリーブ状態を解除して外部からの 要求信号に対する応答を再開させるステップと、前配受 **助通信部がスリープ状態の間、前配能動通信部による要** 前記コンピュータ・ソフトウェアは、スリーブ要求 信号を受信したことに応答して前配受動通信部がスリー **が状態に陥って外部からの要求信号に応答しなくするス** ピュータ可競形式で物理的に格納した配億媒体であっ テップと、スリープ解除要求信号を受信したことに応 特徴とする記憶媒体である。

のコンピュータ・システムに提供することも技術的に可 トウェアをコンピュータ可認な形式で提供する媒体であ る。このような媒体は、例えば、DVD (Digital Vers ットワークは無線、有線の区別を問わない)などの伝送 媒体などを経由してコンピュータ・ソフトウェアを特定 【0025】本発明の第3の側面に係る記憶媒体は、例 sk)、MO (Wagneto-Optical disc) などの槍脱自在で atile Disc) やCD (Compact Disc) 、FD (FloppyDi 可療性の記憶媒体である。あるいは、ネットワーク(ネ コンピュータ・システムに対して、コンピュータ・ソフ えば、さまざまなプログラム・コードを実行可能な汎用 能である。

定義したものである。換言すれば、本発明の第3の側面 によって、コンピュータ・システム上では恊働的作用が 【0026】本発明の第3の側面に係る記憶媒体は、コ ウェアと記憶媒体との構造上又は機能上の協働的関係を ェアをコンピュータ・システムにインストールすること 発揮され、本発明の第1及び第2の各側面に係る無線通 ンピュータ・システム上で所定のコンピュータ・ソフト ウェアの機能を実現するための、コンピュータ・ソフト に係る配徴媒体を介して所定のコンピュータ・ソフトウ

れに対する応答信号を受信する能動通信部とを備えた無 【0027】また、本発明の第4の側面は、外部からの **双永信号を受信するとともにこれに対する応答信号を返 線通信装置の制御をコンピュータ・システム上で実行す** す受動通信部と、外部に要求信号を送信するとともにこ るように記述されたコンピュータ・プログラムであっ

動通信部がスリープ状態に陥って外部からの要求信号に **応答しなくするステップと、スリープ解除要求信号を受** 信したことに応じて前記受動通信部がスリープ状態を解 除して外部からの要求信号に対する応答を再開させるス テップと、前記受動通信部がスリープ状態の間、前記能 て、スリーブ要求信号を受信したことに応答して前記受 を具備することを特徴とするコンピュータ・プログラム 動通信仰による要求信号の送信を禁止するステップと、

を実現するようにコンピュータ可能形式で記述されたコ によって、コンピュータ・システム上では協働的作用が 信装置又はその制御方法と同様の作用効果を得ることが れば、本発明の第4の側面に係るコンピュータ・プログ 発揮され、本発明の第1及び第2の各側面に係る無線通 プログラムは、コンピュータ・システム上で所定の処理 ンピュータ・プログラムを定義したものである。 換言す **ラムをコンピュータ・システムにインストールすること** [0028] 本発明の第4の側面に係るコンピュータ・

後述する本発明の実施形態や添付する図面に基づくより 【0029】本発明のさらに他の目的、特徴や利点は、 詳細な説明によって明らかになるであろう。

[0030]

【発明の実施の形態】以下、図而を参照しながら本発明 の実施形態について詳解する。

タ」と呼ぶときには、無線タグ及びリーダ/ライタ機能 アの様子を示している。この無線通信エリア内では、複 数の無線タグ、並びに複数のリーダ・ライタ装置が混在 している。同図において、参照番号1及び2は無線タグ 【0031】図1には、本発明を実現した無線通信エリ であり、また、参照番号3及び4は無線タグ・リーダ/ ライタである。以下、単に「無線タグ・リーダ/ライ の双方を備えた無粮通信装置であるとする。

出し又は曹き込み要求を送信し、その応答を受信してい イタ3から見ると、無線タグ・リーダ/ライタ4は、無 線タグ1及び2と同様に振る舞いをする。すなわち、無 【0032】図1に示す例では、無線タグ・リーダ/ラ イタ3が同じ無報通信エリア内に存在する無線タグ1及 び2、並びに無線タグ・リーダ/ライタ4に対して読み る様子を示している。この場合、無線タグ・リーダ/ラ 線タグ・リーダノライタ3は、無線タグ・リーダ/ライ タ4も無极タグの1つとして認識する。

【0033】さらに、同図に示す例では、無線タグ・リ リーダ/ライタ4がリーダ/ライタとして能動的な送信 ーダ/ライタ3への干渉を軽減するために、無線タグ・ 信号を送出することを抑制している。

【0034】図2には、無線タグ及びリーダブライタの 双方の機能を備えた無線通信装置100のハードウェア 構成を模式的に示している。以下、同図を参照しながら 各部について説明する。

【0035】参照番号101は不揮発性記憶領域であ

通信装置100の動作を制御するためのプログラム・コ 装置100が無線タグ(若しくはその他の受動的な通信 Programmable ROM)のような音き込み可能な不揮発性メ 置で構成される。この不揮発性記憶領域101は、無線 **ードを保持する制御ソフトウェア格納領域と、無線通信** り、例えばEEPROM (Electrically Erasable and モリ装置や、ハード・ディスク装屑のような外部記憶装 装置)として振舞うときに使用する仮想タグ記憶領域 と、その他の汎用的に使用可能な記憶領域を備えてい 【0036】参照番号102は、出力画面を持った表示 成され、無線通信装置100の操作や状態を表示するた 部であり、例えば液晶表示ディスプレイ(LCD)で構 めに使用される。

【0037】参照番号103は、無線通信装置100全 体の動作を統括的にコントロールする C P U(Central Processing Unit)である。また、参照番号104は、

される。CPU103は、不揮発性記憶領域101の制 御ソフトウェア格納領域から一時記憶領域104上にロ 一時記憶領域104であり、RAM (Random Access Ne mory) のような費き換え可能な揮発性メモリ装置で構成 ードしたプログラム・コードを実行し、また、プログラ ム実行中の作業データを一時記憶領域104に一時保存 420

【0038】参照番号105は、ユーザが操作コマンド 05は、例えば複数のキーやボタン、あるいは、表示部 1 0 2 の表示画面に重畳されたタッチパネルなどで構成 やデータなどを入力するための入力部である。入力部 **される**。 【0039】参照番号106は、無線通信部であり、C う機能モジュールであり、信号の送受信を司るベースパ ンド・プロックや所定のRF周波数信号をアンテナ10 7 を介して送受信する R F ブロックを備えている。無線 通信的106は、例えばFPGA (Field Programmable 埋をプログラムにより変更できる汎用のロジック・デバ P U 1 0 3 からのコマンドに従って外部と無線通信を行 Gate Array)のような、1 C完成後にユーザが内部論 イスで構成することができる。

【0040】本実施形態では、無線通信部106は、外 能と、外部に要求信号を送信するとともに外部からその 部からの要求信号を受信して応答信号を返す受動通信機

芯答信号を受信する能動通信機能とを備えている。但 、、これらの評価については後述に観る。

rnet, RS232C, USB (Universal Serial B us), IrDA, Bluetooth, IEEE 80 2. 11 bなどの標準的なインターフェースで構成する [0041]参照番号108は、外部インターフェース **であり、無様通信装置100をコンピュータやその他の** ができる。外部インターフェースは、例えば、ELhe 情報機器,情報処理端末と接続するために使用すること

模式的に示している。同図に示すように、外部からの要 と、外部に要求信号を送信するとともに外部からその応 【0042】図3には、無線通信部106の機能構成を 求信号を受信して応答信号を返す受動通信部106A **各信号を受信する能動通信部106Bを備えている。**

し要求を受信した場合には、不揮発性記憶領域101の 仮想タグ記憶領域に格納されている要求データを返信す 記憶領域101の仮想タグ記憶領域に要求データを書き 除要求などの要求信号を受信することができる。読み出 る。また、曹き込み要求を受信した場合には、不揮発性 **要求や書き込み要求の他、スリープ要求及びスリープ解** [0043] 受動通信部106Aは、外部から読み出し

とにより、受動通信部106Aからの応答が互いに干渉 【0044】また、受動通信部106Aは、スリープ要 求を受信したことに応答して、スリープ状態に陥る。ス リープ状態では、外部からの読み出し要求や曹き込み要 求に応答しなくなる。例えば、同じ無線通信エリア内で してしまうという問題を回避することができる。スリー **プ状態は、スリープ解除要求を受信してスリープが解除 複数の受動通信部106Aが混在するような場合、特定** の受動通信部106A以外をスリープ状態に設定するこ されるまで継続する。

[0045] 受動通信部106Aは、自身の状態すなわ ちスリープ状態又はスリープ解除状態のいずれであるか を状態保持部1060に保持している。 能動通信部10 Bは、受動通信部106Aの状態保持部106Cにアク セスすることができる。

出し要求や書き込み要求の他、スリーブ要求及びスリー ブ解除要求などの要求信号を送信するとともに、これに 対する応答信号を受信することができる。スリーブ要求 スリーブ状態に遷移させ、また、スリーブ解除要求を送 【0046】一方の能動通信部106Bは、外部に競み を送信することにより、相手方の受動通信部106Aを 旨することによりそのスリーブ状態を解除することがで

かを判別する。そして、スリーブ状態であれば、要求信 前に、受動通信部106A内の状態保持部106Cを参 照して、受動通信部106Aがスリープ状態であるか否 [0047] 能動通信部10Bは、要求信号を送信する

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号の送出をディセーブルする。これによって、例えば同 るような場合に、要求信号が互いに干渉してしまうとい ご無線通信エリア内に複数の能動通信部10Bが混在す う問題を回避することができる。

る動作特性を持つ無線タグと、無線タグ・リーダ/ライ 例として、特定周波数の電波を受信したことに応答して **策別情報や記憶されている情報に相当する電波を発信す** 【0048】受動通信機能と能動通信機能の組合せの-タを挙げることができる。

み替き動作を行なう仕組みについて、図4を参照しなが ら説明する。図示の例では、無線送受信のために電磁投 ーダノライタが受動通信部としての無線タグに対して認 【0049】ここで、能動通信部としての無線タグ・リ 受方式が採用されている。

【0050】同図において、参照番号11は、無線タグ であり、タグ・チップ12とアンテナ13で構成され

は、変隅部20と、整流・復隅部22と、メモリ部23 で構成される。メモリ部23は、仮想タグ配憶領域(前 [0051] アンテナ13には、半波長のダイポール・ アンテナなどが使用される。また、タグ・チップ12 述)に相当する。 ន

希電源に変換されると同時に、この電源により復期機能 が動作開始して、無線タグ11に対する競み取り信号で あることが認識される。発生した電源は、メモリ部23 【0052】無線タグ・リーダ/ライタ10より送信さ 部22に入力される。ここで、電波「oは整流され、直 hた電波 Lots、アンテナ13で受信され、整流・復調 及び変調部20にも供給される。

【0054】このとき、無線タグ・リーダ/ライタ10 【0053】メモリ部23は、内部にあらかじめ格徴さ タとして送る。変調部20は、ダイオード・スイッチ2 |で構成され、送信データにより、ダイオード・スイッ チ21はオン/オフ動作を繰り返す。すなわち、データ ン状態となる。このとき、タグ・リーダ/ライタ10か からの電波は無線タグ11側で吸収される。データが0 の場合は、オフとなり、ダイオード・スイッチ21はオ が1の場合は、オンとなり、アンテナ13はアンテナ・ インピーダンス(例えば、50オーム)で終端される。 れたIDなど僧報を読み出して、変調部20に送信デ ープン状態となり、同時にアンテナ13の終端もオー 5の電波は反射され、送信元に戻ることになる。

【0055】このような通信方法は「バック・スキャッ タ方式」と呼ばれる。こうして、無線タグ11は無電源 で内部の情報を無線タグ・リーダ/ライタ10側に送る ことが可能となる。

タグ読み取りモジュール14と、このタグ読み取りモジ ュール14に接続されたアンテナ15で構成され、ホス 【0056】一方の無線タグ・リーダ/ライタ10は、 ト機器16に接続して使用される。ホスト機器16は、

ナル・コンピュータやPDA (Personal Digital Assis

tant)などの情報端末で構成され、ユーザが対話入力を

[0057] ホスト機器16は、まず、無線タグ11の 読み取り指示をホスト・インタフェース部31を経由し 行うためのユーザ・インターフェースを提供する。 て通信制御部30に通知する。

0からのタグの続み取りコマンドを受け取ると、送信デ ータに編集を行い、フィルタリングを行った後、ASK (Amplitude Shift Keying) 変類部27にペースパンド 信号を送る。ASK変綱部27は、周波数シンセサイザ [0058] ペースパンド処理部29は、通信制御部3 26の周波数 Loピハ S K 狡黠を行う。

われる。ASK変調がかけられた送信信号は、サーキュ る。このホッピングの指示も通信制御第30によって行 レータ24を経由して、アンテナ15より無線タグ11 | からの信号の定在液やマルチバスの軽減のために、無 線タグ11への送信周波数は、ホッピングして用いられ 通信制御邸30によって行われる。一般に、無線タグ1 【0059】周波数シンセサイザ26の周波数設定は、 に向けて放射される。

グ・リーダ/ライタ10から送信された信号と同一周波 数である。この信号は、無線タグ・リーダ/ライタ10 【0060】先に述べたように、パック・スキャッタ右 式で戻って来た無線タグ11からの反射信号は、無線タ のアンテナ15で受信され、ミキサー25に入力され 【0061】ミキサー25には、送信時と同じローカル は、無線タグ11側で変調をかけた信号が現れることに 周波数 foが入力されるため、ミキサー25の出力に

ースパンド処理部29では、データをデコードし、無線 タグ11内のメモリ部23に格納されていたデータを取 【0062】復調部28では、この信号から1/0のデ ータに復凋を行い、ペースパンド処理部29に送る。ベ ホスト・インタフェース邸31からホスト機器16に転 り出す。このデータは、通信制御部30の指示に従い、

【0063】以上のようにして、無線タグ・リーダイラ イタ10は、無線タグ11内の情報を読み出すことがで を無線タグ11内のメモリ部23(すなわち仮想タグ記 きる。また、無線タグ・リーダ/ライタ10は、上近と とができる。この場合、ホスト機器16側の指定データ 回様の動作で無線タグ11への音を込み動作を行なうこ 億領域) に替き込むことができる。

信号に対する応答信号に応じて自身のアンテナ間の負荷 を変化させることによってリーダ、ライタの受信回路に [0064]また、受動通信機能と能動通信機能の組合 せについての他の例として、リーダ/ライタからの要求

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現れる信号に振幅変調をかけて通信を行う非接触1Cカ ード並びに 1 C カード・リーダノライタを挙げることが

せる。一方、1Cカード側では、電気的には1Cカード **凶解している。1 Cカード・リーダ/レイタは、ループ** ナしゅ に電流 1 ゅを流すことでその周辺に磁界を発生さ ド虹のループ・コイルし、 臨には I Cカード・リーダ/ラ **電圧が生じて、ループ・コイルし、端に接続された1Cカ** 間の無線通信は、例えば電磁誘導の原理に基づいて実現 の周辺にループ・コイルし、が形散されている。 1 Cカー 【0065】1Cカードと1Cカード・リーダ/ライタ される。図5には、電磁誘導に基づく1Cカードと1C カード・リーダノライタの無線通信の仕組みを概念的に ・コイルで構成されたアンテナし。を備え、このアンテ イタ側のループ・アンテナし、が発する磁界による誘導 ードの端子に入力される。

は互いの位置関係によって変わるが、系としては1個の ドの続み書き動作を図らに示すようにモデル化すること 【0066】 1 Cカード・リーダ / ライタ側のアンテナ し』とICカード側のループ・コイルし。は、その結合度 トランスを形成していると捉えることができ、1Cカー ができる。

テナしn に流す電流 1n を変糊することで、I Cチップ け、そのことを利用してICカード・リーダ/ライタは 【0067】1 Cカード・リーダノライタ側では、アン 上のループ・コイルし、に務起される電圧Voは変調を受 ICカードへのデータ送信を行うことができる。

[0068] また、1Cカードは、1Cカード・リーダ ルし、の端子間の負荷を変動させる機能 (Load Switchin ると、ICカード・リーダ/ライタ側ではアンテナ端子 間のインピーダンスが変化して、アンテナL **の通過電 流1. や電圧V. の変動となって現れる。この変動分を 復調することで、ICカード・リーダ/ライタはICカ /ライタへ返送するためのデータに応じてループ・コイ g)を持つ。ループ・コイルし、の端子間の負荷が変動す 一ドの返送データを受信することができる。

【0069】すなわち、1Cカードは、1Cカード・リ 自身のアンテナ間の負荷を変化させることによって、カ ーダ/ライタからの要求信号に対する応答信号に応じて ド税み費き装置側の受信回路に現れる信号に振幅変調 をかけて通信を行うことができる。

【0070】図7には、無粮通信装置100における信 Cカード)のような受動通信機能としての振る舞いを 可能にするものであり、例えば、CPU103が不揮発 行するという形態で実現される。あるいは、FPGAな この動作は、無線通信装置が通常の無線タグ(あるいは 記憶領域101に格納されている制御ソフトウェアを実 どによって構成された無線通信部106内のベースパン ド・ブロックに実装されたロジックによって実現するこ 号受信処理動作をフローチャートの形式で示している。

とも可能である。以下、このフローチャートを参照しな がら、無線通信装置100における信号受信処理につい

が起動すると、まずステップS1において、スリープ状 【0071】無粮通信装置100において信号受信処理 **悲をオフに初期化する。そして、これ以降、ステップS** 2で信号受信待ちの状態となる。

の受動通信機能から応答信号を受け取ったり、あるいは ダ/ライタ)などの能動受信機能から要求信号を受け取 (0072) 信号受信待ち状態において、無線通信装置 00が、外部の無線タグ(あるいはICカード)など 無粮タグ・リーダ/ライタ(あるいは1Cカード・リー ると、ステップ S 3 に進んでスリーブ状態の判定を行

図9にて説明する。

合、スリープ中にある無粮通信装置100は、何も処理 【0073】判断ブロックS3において、スリーブ状態 で、さらに受信した信号がスリーブ解除要求であるかど 要求であると判定された場合には、次ステップS5に進 **んで、スリープ状態をオフに設定した後、ステップS2** 【0074】他方、ステップS4においてスリープ解除 うかの判定を行う。スリープ解除要求以外の信号の場 がオンであると判定された場合、ステップS4に進ん をせずにステップ 3 2 に戻り、次の信号受信を待つ。 に戻り、次の信号受信を待つ。

リーダ/ライタ)としてさまざまな要求を送信できる状 [0075] ステップS5における処理を行うと、この 無線通信装置100は、スリープ状態が解除され、無線 タグ(あるいはICカード)などの受動通信機能として に、無粮タグ・リーダノライタ(あるいは1 Cカード・ さまざまな要求に対して応答できる状態となるととも

動通信機能からの要求信号であるか、又は、他の無線タ グ(又はICカード)などの受動通信機能からの応答信 [0076]また、判断プロックS3において、スリー プ状態がオフであると判定された場合には、ステップS 6 に進んで受信した信号が、他の無線タグ・リーダ/ラ イタ(あるいは1Cカード・リーダ/ライタ)などの能 号であるかを判定する。

タ)などの能動通信機能からの要求信号であると判定さ 【0077】判断プロックS 6において、他の無線タグ ・リーダノライタ (あるいは10カード・リーダ/ライ れた場合には、ステップS7に進んで、さらに受信信号 がスリープ要求であるか否かを判定する。

あると判定された場合には、次S8においてスリープ状 態をオンに設定した後、ステップ 3 2に戻り、次の信号 【0078】判断プロックS7においてスリープ要求で 母信を待り。

タグ(あるいは1Cカード)などの受動通信機能として 【0079】ステップS8の処理を行うと、この無線通 昌装置100は、スリープ状態が解除されるまで、無線

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さまざまな要求に対して応答しなくなるとともに、無線 ライタ)などの能動通信機能としてさまざまな要求を送 タグ・リーダ/ライタ (あるいはICカード・リーダ/

(あるいは10カード) などの受動通信機能としての擬 る舞い、すなわち要求受信処理を行う。その後、ステッ プS2に戻り、次の信号受信を待つ。ステップS10に 【0080】また、判断プロックS7において、受信信 おける要求受信処理については、紙面の関係上、別途、 号がスリーブ要求以外であると判定された場合には、 テップS10に進んで、無線通信部106は無線タグ

信処理については、紙面の関係上、別途、図8にて説明 るいはICカード)などの受動通信機能からの応答信号 なわち広答受信処理を行う。その後、ステップS2に戻 り、次の信号受信を待つ。 ステップS 9 における応答受 リーダ/ライタ)などの能動通信機能からの要求信号で はないと判定された場合、すなわち、他の無線タグ(あ 無線タグ・リーダ/ライタ(あるいは1Cカード・リー ダノライタ)などの能動通信機能としての振る舞い、す であると判定された場合には、ステップS9に進んで、 【0081】判断プロックS6において、受信信号が、 他の無線タグ・リーダ/ライタ(あるいはICカード 8

【0082】図8には、図7に示したフローチャート中 **一トの形式で示している。この応答受信処理は、無線通** Cカード・リーダ/ライタ)などの能動通信機能として CPU103が不揮発記憶領域101に格納されている あるいは、FPGAなどによって構成された無線通信部 106内のベースパンド・プロックに実装されたロジッ りによって実現することも可能である。以下、このフロ ーチャートを参照しながら、無線通信装置100の応答 信装置100が無線タグ・リーダ/ライタ (あるいは1 のステップ9における広答受信処理の手頃をフローチャ 制御ソフトウェアを実行するという形態で実現される。 の振る舞いに相当する。この応答受信処理は、例えば、 受信処理について説明する。

【0083】無線通信装置100は、応答信号受信処理 開始後、応答結果を作成し、呼び元の手続きに処理を返 ート中のステップ10における要求受信処理の手順をフ 【0084】また、図9には、図7に示したフローチャ は、無稳通信装置100が無線タグ(あるいは1Cカー ローチャートの形式で示している。この要求受信処理 して(ステップS21)、応答受信処理を終了する。 \$

この要求受信処理は、例えば、CPU103が不揮発配 によって構成された無線通信部106内のペースパンド 億領域101に格納されている制御ソフトウェアを実行 するという形態で実現される。あるいは、FPGAなど ・ブロックに実装されたロジックによって実現すること ド)などの受動通信機能としての振る舞いに相当する。 S

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も可能である。以下、このフローチャートを参照しなが ら、無線通信装置100の要求受信処理について説明す

東東が1D篠別要求であるか否かを判別する。1D篠別 要求である場合には、ステップS32に進んで、1D鸛 の実施形態では、不抑発記憶領域101の仮想タグ記憶 【0085】まず、ステップS31において、受信した 別処理を実行する。ID離別処理とは、この無線タグな どの受動通信機能が持つIDを読み出すことである。こ **領域内から10が読み出されて、**要求元に送出される。

スパンド・プロックに実装されたロジックによって実現 することも可能である。以下、このフローチャートを参

照しながら、無線通信装置100における信号送信処理

にしてれ既配する。

【0090】この処理手順は、例えば、CPU103が アを実行するという形態で実現される。あるいは、FP

不御発記憶領域101に格納されている制御ソフトウェ GAなどによって構成された無粮通信部106内のベー

* 熋(すなわちスリーブ状態であるか否か) に応じて能動

的な要求信号の送信処理を制限するようになっている。

抑発記憶領域101内の仮想タグ記憶領域に対して、要 の実施形態における曹き込み処理とは、図2に示した不 [0086]また、受信した要求がID徽別要求でなけ れば、次いでステップS34において、昔き込み要求で ステップS35に進んで、魯き込み処理を実行する。こ あるか否かを判別する。曹き込み要求である場合には、 求された位置に、要求された情報を曹き込むことであ

れば、次いで次いでステップS36において、読み出し **型状であるか否かを判別する。読み出し要求である場合** る。この実施形態における読み出し処理とは、図2に示 した不相発配位領域101内の仮想タグ配位領域に保持 されている情報を、要求された位置から、要求されたサ 【0087】また、受信した要求が曹き込み要求でなけ には、ステップS37に進んで、読み出し処理を実行す イズで読み出すことである。

ステップS33で要求元に応答信号を送信して、本処理 【0088】これら受信した要求の処理を行なった後、 ルーチン全体を終了する。

8 [0089] また、図10には、無線通信装置100が 信号送信処理を行うための処理手順をフローチャートの 形式で示している。この処理手順によれば、無線タグ・ リーダノライタ (あるいは1 Cカード・リーダノライ

取タグ (あるいは I Cカード) などの受動通信機能の状* タ)などの能動通信機能として振る舞いをする際に、無

各種要求信号の送信を行う際、まずステップ S 4 1 にお いて、無線タグ(あるいは1Cカード)などの受動通信 は、他の無線通信装置との間で要求信号が互いに干渉す る心配はないので、ステップ 8 4 2 に進んで要求信号送 01内に格納されている制御ソフトウエアの動作により 【0092】スリープ状態ではないと判定された場合に 【0091】無線通信装置100は、不揮発記憶領域1 機能部106Aがスリープ状態であるか否かを判別す 信をそのまま実行する。 ຂ

【0093】他方、判断プロックS41において、無線 6 Aがスリープ状態であると判定された場合には、信号 に、ステップS43に進んで、応答結果にスリープ中を タグ (あるいは1Cカード) などの受動通信機能部10 送信を制限して他の要求信号との干渉を回避するため 散定して、本処理ルーチンを終了する。

る要求信号をまとめている。上述した本発明の実施形態 信号を送信できる機能を持つ必要がある。ここに示した における無線通信装置100は、最低限、これらの要求 以外の要求信号については必要に応じて追加・変更して 【0094】以下の表1には、無線タグ及び無線タグリ 一ダ・ライタ装置で構成される無線通信装置間で使用す

[0095]

[条1]

76.01	734
I D識別要求	周囲の無線タグ、無線タグリーダ・ライタ装置が持つ IDを取得するための要求信号。
スリーブ要求	周囲の無線タグ、無線タグリーダ・ライタ装置に対し でスリープ状態にさせるための要求信号。
スリーブ解除要求	周囲の無輪タグ、無輪タグリーダ・ライタ装置に対し てスリープ状態を解除させるための要求信号。
書き込み要求	周囲の無線タグ、無緯タグリーダ・ライタ装置に対し で情報を書き込むための要求信号。
飾み出し要求	周囲の無輪タグ、無線タグリーダ・ライタ装置から情報を誘み出すための要求信号。

S 施形における無頼通信装置100は、最低限、これらの 【0096】また、以下の表2には、無線タグ及び無線 タグリーダ・ライタ装置で構成される無線通信装置間で 使用する応答信号をまとめている。 上述した本発明の実

広答信号を送信できる機能を持つ必要がある。ここに示 してもよい。

[0007]

した以外の応答信号については必要に応じて追加・変更

9

<u>_</u>

[表2]

信号名	内容
吳空昭開 Q I	無線タグ、無線タグリーダ・ライタ装置が持つIDを 要求元に返すための応答信号。
書き込み応答	無線タグ、無線タグリーダ・ライタ装置が持つ記憶領域に情報を書き込んだ結果を返すための応答信号。
割み出し広答	無線ケグ、無律ケグリーダ・ライタ装置が持つ配像質 域から情報を読み出した結果を返すための店等信号。

いら、本発明について辞解してきた。しかしながら、本 発明の要旨を逸脱しない範囲で当業者が該実施形態の修 正や代用を成し得ることは自明である。すなわち、例示 という形態で本発明を開示してきたのであり、本明細曹 の記載内容を限定的に解釈するべきではない。 本発明の 要旨を判断するためには、冒頭に記載した特許請求の範 【0098】 [追補] 以上、特定の実施形態を参照しな 田の欄を参酌すべきである。

寺定周波数の電波を受信したことに応答して離別情報や 配憶されている情報に相当する電波を発信する動作特性 を持つ無線タグを用いて非接触通信を行う、優れた無線 **番信装置及びその制御方法、記憶媒体、並びにコンピュ** 発明の効果】以上詳記したように、本発明によれば、 ータ・プログラムを提供することができる。 [0000]

[0100]また、本発明によれば、無線タグ及び無線 タグ・リーダ/ライタ機能の双方を装備して無線通信エ リア内で好適に動作する、優れた無線通信装置及びその 制御方法、記憶媒体、並びにコンピュータ・プログラム

を提供することができる。

ア内に複数の無線タグや無線タグ・リーダ/ライタが混 [0101]また、本発明によれば、同じ無線通信エリ 在するような環境において無線タグ・リーダ/ライタ同 士の干渉を防止することができる、優れた無線通信装置 及びその制御方法、記憶媒体、並びにコンピュータ・プ ログラムを提供することができる。

リーダノライタからなる無線通信システムにおいて、無 娘タグ・リーダノライタに無線タグと同等の機能を付加 することによって、無線タグ読み魯き装置自体が、他の 無線タグ読み魯き装置からの要求に対して無線タグとし ての振る舞いをすることができる。また、外部の無線タ に、無線タグにおける受動的な信号送信を禁止すること に運動して、無穏タグ・リーダ/ライタにおける能動的 【0102】本発明によれば、無線タグと、無線タグ・ な信号送信も禁止することにより、他の無線タグリーダ ライタとの互いの要求信号の干渉を軽減することがで ゲ・リーダ/ライタからスリープ要求を受信したとき

タグ・リーダ/ライタ間の無線規格に特に変更を加える ことなく上配の効果が得られることから、実装コストを 大幅に低減することができる。

【図1】本発明を実現した無線通信エリアの様子を示し 【図画の簡単な説明】

【図2】無線タグ及びリーダノライタの双方の機能を備 えた無線通信装置100のハードウェア構成を模式的に 示した図である。 た図である。

【図3】無線通信部106の機能構成を模式的に示した プロック図である

【図4】 能動通信部としての無線タグ・リーダ/ライタ が受動通信部としての無線タグに読み替き動作を行なう 仕組みを説明するための図である。 ន

【図5】電磁誘導に基づくICカードとICカード・リ **- ダノライタの無線通信の仕組みを概念的に示した図で** 8 %

【図6】1 Cカードの読み售き動作をモデル化した図で

【図7】無線通信装置100における信号受信処理動作 をフローチャートの形式で示した図である。 ₹. 80°

おける広答受信処理の手髄を示したフローチャートであ 【図8】図7に示したフローチャート中のステップ9に

0 における要求受信処理の手順を示したフローチャート 【図9】図7に示したフローチャート中のステップS1

【図10】無粮通倡装置100が倡号送倡処理を行うた めの処理手順を示したフローチャートである。

[作号の説明]

100…無粮通信装置

101…不抑発性記憶領域

03...CPU

04…一時記憶領域

05…入力部

06…無類通信部

07…アンテナ

108…女郎インターフェース

【0103】さらに、本発明によれば、無線タグと無線

